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Electrical World

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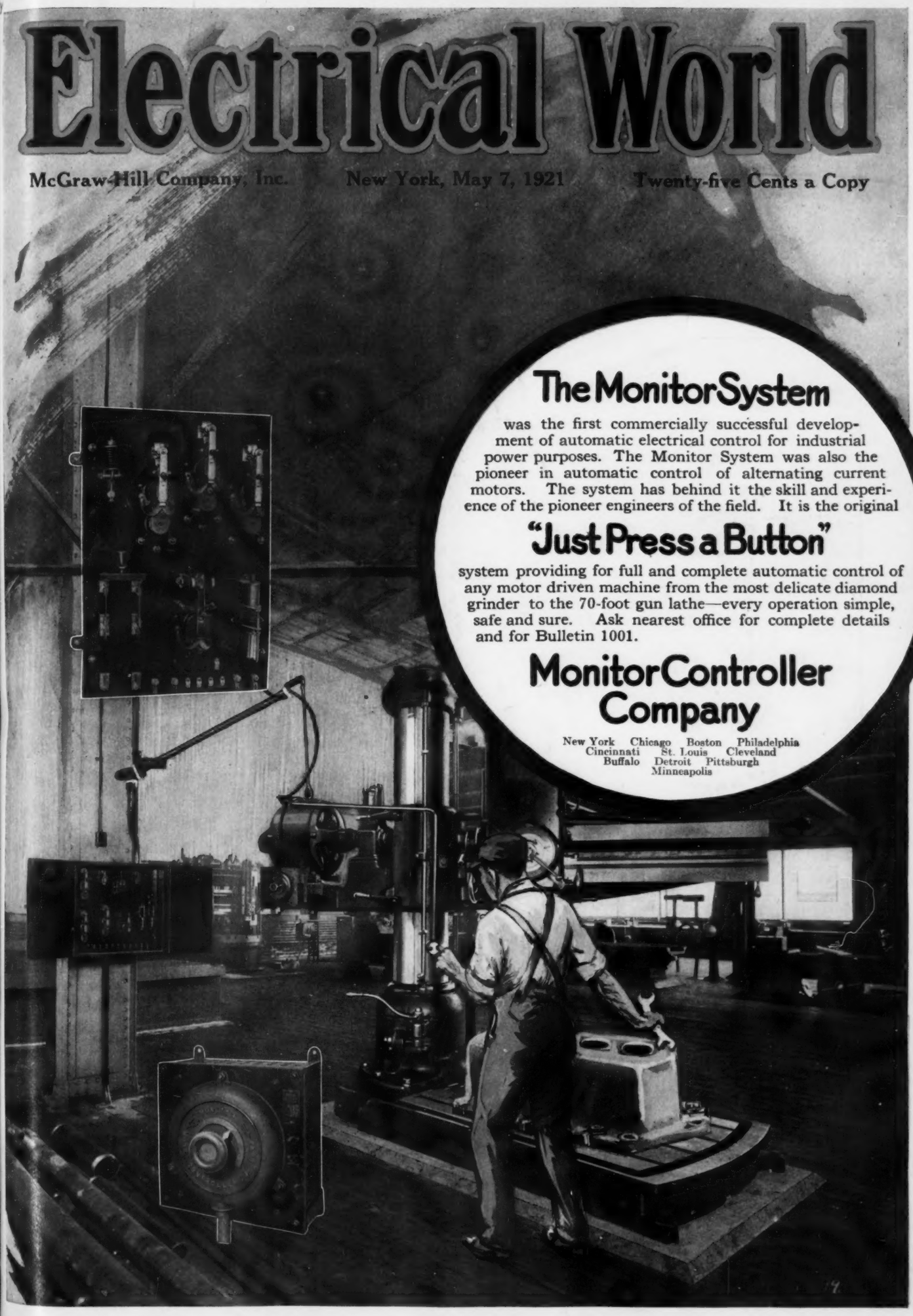

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Electrical World

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A Business Man's Defense of Public Utilities

EDWARD N. HURLEY'S speech before the Chamber of Commerce of the United States of America at Atlantic City last week was most excellent and salutary. While he spoke as a business man to business men, no operator could have presented the public utility case better or added much to the vigor of the argument; and it is certainly a matter of congratulation that the electrical industry has so stanch a friend and supporter as Mr. Hurley. As former head of the Federal Trade Commission and of the United States Shipping Board, Mr. Hurley's testimony on the efficacy of government ownership and operation was as frank as his strictures were damning. In his estimation there should be erected across all roads leading to government ownership danger signs reading, "This way leads to inefficiency and failure." Mr. Hurley has little patience with those who on account of misunderstanding or of the shortcomings of utilities advocate municipal ownership, because he is convinced that municipal or governmental ownership will not give the relief desired. Hence his plea that unless the public, the state commissions and the utility corporations work together and create that measure of confidence which will influence people to invest in utility securities further development of electrical utilities by private initiative will be arrested to the detriment of the entire country. But, while asking for justice for the utilities, Mr. Hurley is just as insistent that the utilities give service that will merit fair or better treatment, and we trust that this part of his utterance will not fall on deaf ears.

Plans of the Colorado River Commission

THE electrical utilities of the Southwestern States have a most vital concern with the actions and plans of the newly formed Colorado River Commission, and they should not delay in making this plain. This commission has been fostered by the League of the Southwest, which is composed of representatives of the seven states in which the Colorado River basin lies, and, as now constituted, it consists of the state engineers of these states and engineers from the Reclamation Service. It is proposed, and perhaps rightly, that the further development of the Colorado be primarily for irrigation purposes, the generation of power to come after all the requirements entailed by the control of a stream for irrigation have been taken care of. The director of the Reclamation Service has stated that the division of power developed will be made in the following order: First, for pumping of irrigation water on the projects; second, for municipal uses by towns in the projects; third, for the use of other municipalities, and, fourth, for sale to industries, etc. In the plans thus far contemplated by the commission the generation of power will be the last thing considered. But it is not the last thing which should be considered. In California particularly the power available from the Colorado River will in years to come be the mainstay of industrial progress. The undeveloped hydro-electric power in that state is not unlimited. At present rates of growth the larger sites will have been well developed in fifteen years, and recourse must then be had to the power of the Colorado. It is not reasonable to infer that at that time the supply of electrical service to the industries and farms of the state will be turned over to the municipalities for further exploitation. It therefore is urgent that the utilities, perhaps through the National Electric Light Association, be ably represented upon the Colorado River Commission and see to it that the needs of the electrical industry shall receive due consideration from the standpoints of adequate electric service and the upbuilding of industries and communities depending upon that service.

Central-Station Profits that Stay Afloat

THERE is a lingering thought in the fact that the selling of appliances by central-station companies is a business that floats on the tide. Costs may rise and fall, but a margin of profit remains. No inflexible rate schedule strangles profit when expenses are abnormal. As costs go up prices proportionately advance and the business still pays as it should, and in times of stress added effort in this department may retrieve much ill fortune. Surely this is something to be carefully considered. Sales department policies and appropriations should be shaped not alone on experience purely local but with a mind to future needs and proved possibilities elsewhere. Electric labor-saving household appliances are fast becoming staples in the homes of every city. A prosperous store that stimulates the demand is a help in building revenue and defining service in a practical way.

Conservatism Marks English Plans for Power Supply

PLANS for consolidating the power supply in England, which include the building of superpower stations and the shutting down of inefficient sources, have been progressing somewhat deliberately, but nevertheless to good purpose, and the latest advices show that they are measurably near to producing results. For convenience there will be two general stages of operations. Under the first stage, while superpower stations are being built, there will be merely the opportunity to shut down thirty-four conspicuously inefficient plants, supplying the necessary output by wholesale purchase from the

remaining plants. When the superpower stations come along twenty-six more plants of lesser commercial efficiency will follow the first group, leaving seventeen of a higher type temporarily to continue. Gradually, as superpower stations come into full action, part even of this number will be dispensed with, only a few remaining to serve as auxiliaries to the greater project. Existing stations for railway purposes will be continued, although new electrifications will be carried out from the general power supply. The whole question of railway electrification is in so unsettled a condition that it is a material obstacle in the unification of electrical supply.

The existence of a large bulk of power supply which ultimately must be in the form of direct current of indeterminate voltage must be dealt with as an existing fact. This introduces a somewhat troublesome economic factor in any consideration of superpower projects, which must in the long run have much to do with railway electrification.

Improper Fusing of Fuse Plugs

JUDGING from the following incident, there is need for some popular education in safe uses of electricity. Apparently the bridging of fuses with copper coins is quite common, so common in fact that some means ought to be found to check the practice. "One morning last week," writes an inspector, "I took some time off and inspected one block of the business district just to see how the electrical work is, and from a financial standpoint I did very well, having gathered twenty-three pennies from the back of plug fuses to say nothing of pieces of copper." Sitting on the safety valve ought to be a penal offense, but the great difficulty is to prove the crime. It is hard to attribute the practice to ignorance. We can believe that a woman will connect to a lamp socket a device which will overload it because she doesn't know any better, or leave a flatiron in circuit on a table through carelessness, but any one putting a cent in a fuse plug knows what he is doing and why. He is an enemy to society in that he willfully makes non-effective safety devices installed for public protection. Such a person should be incarcerated. No other punishment fits the crime.

Working with the Metallurgical Engineer

IN MANY respects procedure in the various branches of the engineering profession runs along parallel lines. In dealing with specialized applications, however, there is an overlapping of fields, and the division of work among specialists is not always clear. Such a relation exists between the metallurgical and the electrical engineer where electric furnace problems are involved. Beginning as a metallurgical problem, the electric furnace has by the very magnitude of its application become a problem for the electrical engineer as well. Producing a metal with certain qualities is undoubtedly the work of an engineer who devotes his efforts to such investigation; but where the means of production depends upon a source of power such as electricity, it is natural that the electrical engineer, who is responsible for continuous production through this application, should be vitally interested.

To use the electric furnace successfully is very definitely an electrical problem as well as a metallurgical one. This is clearly shown by the marked interest taken in furnace development by the industrial electrical engineers of the country. Probably no engineering group has made a more comprehensive study of furnace characteristics than that made by the electrical engineers connected with the steel industry. Such study has overlapped the metallurgical field only far enough to determine the production methods affecting the electrical apparatus used, energy consumption and so forth. For example, the nature of material handled, the rate of production, the size of the unit or units needed to produce this output and the location of units with respect to the source of power and with relation to the production department are subjects for the mutual consideration of both the metallurgical and the electrical engineer.

It is often contended that even these subjects are in the field of the production department, but when one stops to consider the extent to which the use of the electric furnace adds new duties to the electrical department it is evident that the electrical engineer charged with the responsibility of electrical operation and maintenance of a large industry becomes a vital element of the production organization. In the past the production department too frequently selected electrical equipment on the basis of apparent production needs without much consultation with the electrical engineer. As a result machines were sometimes obsolete electrically before they had served their normal life from a production standpoint. Where a piece of apparatus as important as the electric furnace is involved, such questions as type of equipment to use, nature of installation and method of operation should be jointly answered by electrical and metallurgical engineers, and mutual responsibility should exist from the time the problem is first considered rather than start when the problem of operation to secure economical production is faced.

Regular Inspection Schedules a Necessity

MAINTENANCE that will prevent trouble rather than cure it is a money saver, both directly in preventing loss due to service interruptions and indirectly because of the confidence that good service gives to consumers. In too many plants, particularly the smaller ones, original designs are so worked out that it is impossible to inspect oil switches, buses and other parts of the installation without serious interruption to service. Inspection in these cases is usually of the sporadic, "when-we-can-get-to-it" type. It is expensive and generally is postponed until forced by a serious breakdown. Much of such maintenance work is relegated to the low-load hours after midnight or to Sunday, and it is done so hurriedly that it lacks effectiveness.

Inspection schedules such as that of the Syracuse Lighting Company, described elsewhere in this issue, are needed in every plant. While original design may make such schedules difficult, it is well to remember that there is opportunity from time to time, when heavy maintenance work must be carried out, to rearrange plant equipment in such a way as to permit better routine inspection and maintenance. Such arrangement does not always or even usually mean heavy investment in duplicate items like oil switches, buses and transformers. An air-break switch arranged to shunt an oil switch

for inspection purposes can be cheaply installed where duplicate switches are unwarranted. Proper sectionalization of buses, with light transfer buses to care for circuits while bus sections are cut out for inspection and maintenance, are cheap and usually easy to arrange. One spare transformer can be made to serve for two or more banks.

Every plant should have its routine inspection and maintenance system, and if inspection is difficult to carry out because of the manner in which the plant is designed, the responsible head should seize opportunities for inspection and maintenance as from time to time changes become necessary.

Maintaining Permanent Test Conditions

THERE is always supposed to be a very material difference between the everyday working condition of a plant and that maintained when it is undergoing tests. This difference means one of two things—either the conditions of an efficiency test cannot be practically maintained over considerable periods or else the plant is normally allowed to get into a more or less slovenly condition. However, it is possible to keep plant operation somewhere nearly up to the standards set in an acceptance test, and furthermore it pays to do so. The chief factor in keeping the whole plant tuned up is the maintenance of day-by-day records of just what every part of the plant is doing.

Reserved Police Power and "Scraps of Paper"

OVER and over again have state courts held, and over and over again have federal courts sustained them in so holding, that the reserved police power of the state delegated to a public service commission gives to that commission the power to alter contracts between public utilities and municipalities or between public utilities and private customers when the terms become unjust to either of the parties they were meant to bind, no possible infringement of the constitutional prohibition of legislation impairing contracts being involved. This is an outstanding fact in public utility jurisprudence that puts it, so to speak, in a class by itself.

It is unfortunate that the doctrine, which in its essence was reaffirmed at Washington a week or two ago by the highest court in the land, is so little understood by the people at large. The average man can readily see that justice is served when statutory rates which have become confiscatory are upset under the Fourteenth Amendment as the cause of deprivation of property without due process of law; but why fixed-term contracts entered into deliberately and duly signed, sealed and delivered should not have to run their term is beyond his comprehension. He demands to know why the Prussian doctrine of scraps of paper should be applied to such agreements and hotly asks what a breach of faith is if this be not one.

In the interest of good public relations, every utility in whose interest this police power is successfully invoked should issue a statement to every customer affected by the increased rate explaining the legal doctrine under which the contract has been changed, dwelling on the fact that this doctrine works both ways, and making it clear that in the interest of the customers themselves rates must be high enough to insure proper service and that to attempt to force individuals or stockholders to supply such service at a loss, under contracts based on beliefs which have since been proved fallacious, would be not only a futile but itself an unethical proceeding.

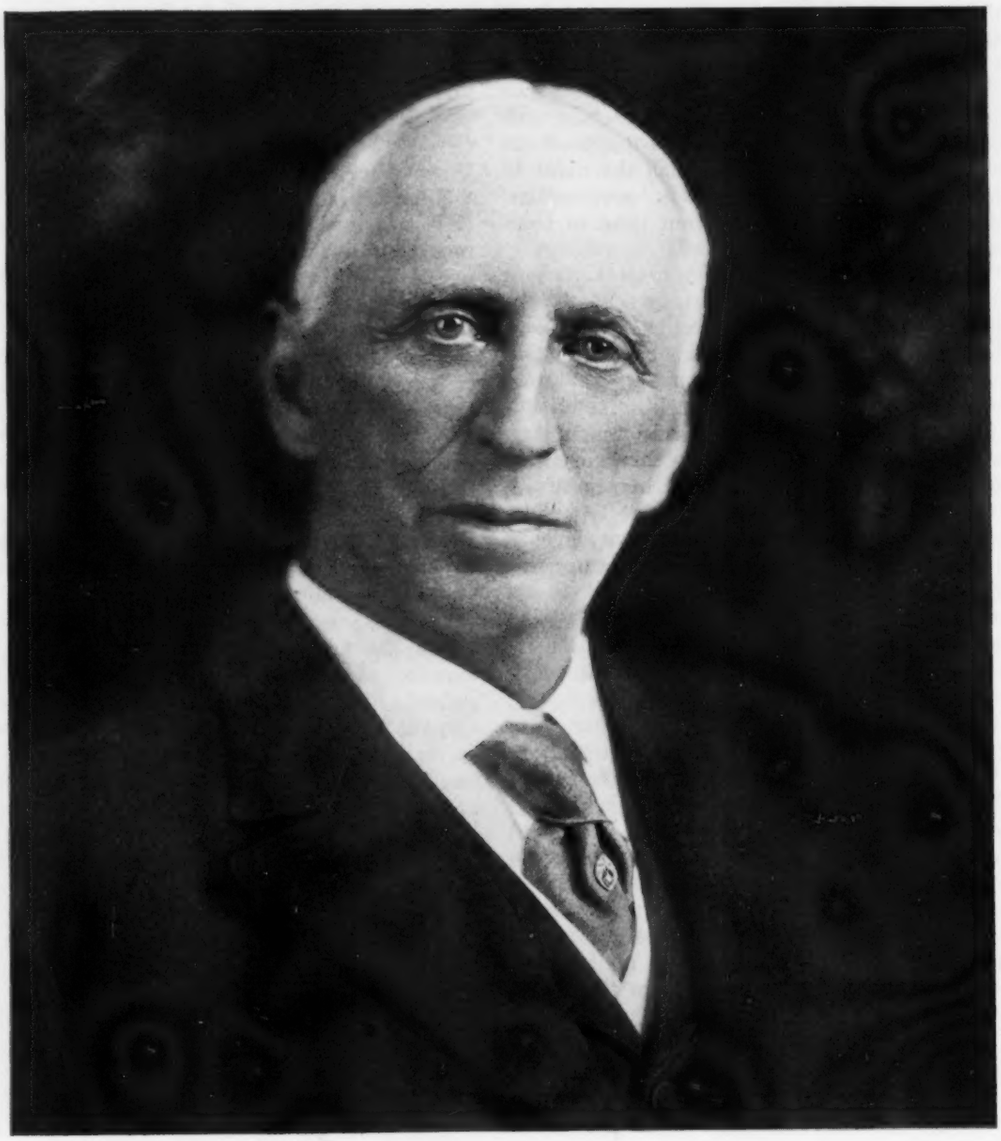
Just One Example of What Can Be Done with Electric Trucks

WHEN it is realized that one electric truck of about two tons capacity will handle the work formerly requiring five hand trucks, will do it more quickly, greatly facilitating prompt loading, and at singularly moderate expense, it becomes clear that a great change for the better has taken place. According to the experience at the Grand Central Terminal, New York, related on page 1041, not the least of the advantages of the electric truck is that the men who handle the baggage piled upon it are not exhausted by a sprint for the baggage car, but get there much more quickly than in the old days and fresh for the task of loading. The mere ability to get mails and baggage aboard at the last minute owing to the speed with which mechanical haulage does the work is a great convenience to the railways and to the public as well.

One remarkable feature of the situation is the way in which the trucks endure in service and the modest expense of operating them, considering the benefits gained. The first truck placed in operation at the Grand Central Terminal ten years ago is still in good condition on its daily job. There are now forty-six of the regular baggage trucks in operation besides five freight trucks of similar capacity. They are all two-ton trucks driven by a 2½-hp. motor, fed from a battery of nearly 200 ampere-hours capacity. All batteries are interchangeable and all are charged separately, none ever being out of commission waiting for a new battery. A truck is merely run up to the charging station, the old battery removed and a new battery is put in on a definite schedule.

Every month or so each truck receives an inspection in the maintenance repair shop, where necessary small repairs are made, the brakes, steering gear and control in particular being tuned up so that the machine will work with the utmost facility. About every two years a complete overhauling is given at the central shop, where machine tools are at hand and all the apparatus can be taken down for repair or renewal. The average life of the batteries has proved to be about twenty-seven months, and for the fifty-one trucks in use seventeen spare sets are kept at hand. Through all the service careful check is kept on the cost so that the expense of mechanical and electrical maintenance work is thoroughly well known. It amounted in 1919 to 26.3 cents per truck-mile, a little more than one-third of the total operating expense for the same year. All told this amounted to 72 cents per truck-mile. The mechanical and electrical maintenance costs are about the same, while the battery repairs and renewals and charging energy altogether foot up to about 6½ cents per truck-mile, plainly demonstrating that the battery costs are by no means a forbidding item.

What has been done in the Grand Central Terminal by small industrial trucks can be done in many places other than railway stations. It is merely a question of picking out the right truck for the job and giving it proper care.



Charles William Holtzer

Electrical manufacturer whose forty-six years of service, marked by executive ability, technical insight and sympathetic appreciation of honest effort, have built, besides a successful business, the loyal co-operation and affection of fellow workers

FROM the experiences of those pioneer workers in the electrical industry who have applied their energies to the working out of original tasks there has been established a source of inspiration of lasting value to those who are now responsible for the solution of newer and more complex problems. Among those who have steadily worked behind the scenes from the very beginning of the electrical industry, with no desire for public acclaim of their significant accomplishments, is Charles William Holtzer, founder and president of the Holtzer-Cabot Electric Company, Boston. Born in Karlsruhe, Baden, Germany, in 1848, and coming to the United States eighteen years later, after receiving a thorough classical education, Mr. Holtzer was for two years engaged in experimental work in the manufacture of heavy ammunition. Shortly afterward he became associated with E. S. Ritchie & Sons, Brookline, Mass., makers of philosophical instruments, and continued there until 1875. Meanwhile he had become interested in electrical development and, realizing the enormous possibilities in the manufacture of electrical apparatus, he went into business at Brookline in his own name in 1875, years before the first central station, producing batteries, bells, switches, etc.

In 1880 he took a contract to operate a telephone exchange of thirteen subscribers at Brookline, the first in the Boston suburban district. The manufacture of lamp fittings and telephone repair work were added, with the manufacture of magnetos, and subsequently of motors, generators, signal equipment, etc. In 1887 Mr. Holtzer formed a partnership with George E. Cabot, and in 1889 the Holtzer-Cabot Electric Company was incorporated. The business was successful from the outset, and it has grown in variety of products, number of employees and output until it now occupies a six-story factory in Roxbury, representing an investment of about three-quarters of a million dollars. During the war over 90 per cent of the output was for the United States government. In 1891 Mr. Holtzer built what is believed to have been the first electric automobile operated in the country, and in 1892 he built with William Stanley two electric motors of pioneer design.

Throughout his long career Mr. Holtzer has displayed the keenest interest in manufacturing problems and the executive aspects of production. His business sagacity, executive ability, technical insight and deep concern for the welfare of his employees have carried him to a commanding position in the manufacturing world. Recently 179 employees, ranging in terms of employment from ten to forty-four years, in expressing their appreciation of Mr. Holtzer's leadership, summed up his accomplishments by saying: "Our factory is a monument to thrift and honest industry and a memorial to merited success."

Essential Design Data for Choosing Synchronous Machines

Broad Principles from Which Engineers May Study Effect of Kva. Rating and Speed on Weight and Efficiency of Synchronous Machines—Important to Those Applying Machines as Well as to Designers

By THEO. SCHOU
Chief Engineer the Ideal Electric & Manufacturing Company

ALTHOUGH the design of electrical apparatus is an art more than a science, certain fundamental laws apply which can be represented as mathematical curves characteristic of the line of equipment in question. The curves which represent design-constants* are just one example of this fact, and others can be plotted which give relations between performance, effective weights of material involved, ratings, speeds, etc. It is to analyze these relations and submit them in the form of curves that this discussion is written.

Among the advantages of the method and curves to be presented, is the elimination of much of the usual cut-and-try work. They should also be useful to engineers who have to select and apply electrical machinery because they give an understanding of the effect of speed, kva. rating and other factors on efficiency, weight and consequently cost. Although the data given are approximate, they are based on experience and may therefore be used by operating and industrial engineers for estimating purposes. The weights of effective material are also helpful in comparing the suitability of different machines intended for the same operating conditions. Use has even been made of such data for calculating salvage value of equipment.

It should be borne in mind that the line under discussion involves 60-cycle alternators and motors which will operate at full kva. rating at 80 per cent power factor with a temperature rise not exceeding 50 deg. C. in any part of the machine. The stators are wound for standard voltages up to and including 2,400 volts, for two-phase and three-phase, with the excitation based on 125 volts.

CONSTANTS UPON WHICH DESIGN IS BASED

Whereas design-constant curves give information as to the relation of dimensions, an "armature-strength (*A-S*) curve," designating effective ampere-conductors per linear inch of armature surface, may be derived which will give information as to the electrical and magnetic properties. The *A-S* constant is defined by the equation:

$$A\text{-}S = (I \times N \times f_{ch})/(\pi \times D_g) \qquad (1)$$

where:

I = current per terminal,
N = total effective conductors in the stator slots,
f_{ch} = chord factor, or factor depending upon the throw of the stator coils, and
D_g = gap bore, or inside diameter of the stator in a revolving-field machine.

According to the previously mentioned article, it was found that

$$D \times L = [(D_g^2 \times l \times \text{r.p.m.})/\text{kva.}] \times \Sigma K_1 \qquad (2)$$

where:

$D \times L$ = design constant,
D_g = gap bore,
l = length of stator core including ducts,
r.p.m. = synchronous speed in r.p.m.,
kva. = normal 50-deg. rating,
ΣK_1 = constants varying as to phase and design details.

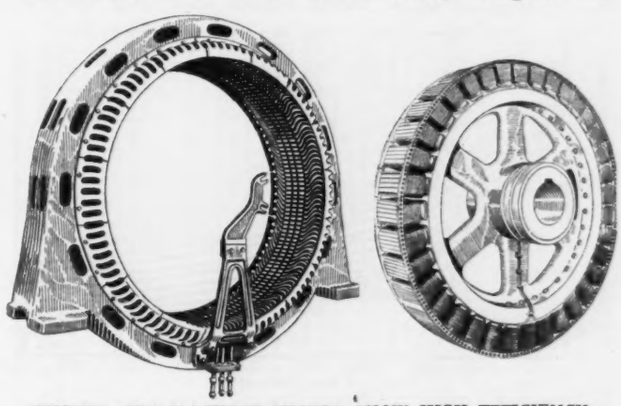
In a similar way:

$$A\text{-}S = [\text{kva.}/(D_g^2 \times l \times \text{r.p.m.})] \times \Sigma K_2 \qquad (3)$$

Or, by substituting:

$$A\text{-}S = [1/(D \times L)] \times \Sigma K \qquad (4)$$

Therefore, if a line of symmetrically designed machines is investigated as to these constants, and the kva. and speed are plotted on plain co-ordinate paper, we would obtain curves like those in Fig. 1, indicating clearly that the *A-S* curves are the reciprocals of the $D \times L$ curves.†



ENGINE TYPE MACHINE SHOULD SHOW HIGH EFFICIENCY BECAUSE FRICTION AND WINDAGE ARE CHARGED TO PRIME MOVER

When the *A-S* curves are given it is possible to derive from them several other characteristic curves relating to performance, design and weights. For example, from the equation (1):

$$N = (\pi \times D_g \times A\text{-}S)/(I \times f_{ch}) \qquad (5)$$

Thus the total number of effective stator conductors may be computed.

If the current density per square inch in the stator copper be designated by A, and the cross-section of the conductor in square inches by q, then:

$$A = I/q, \text{ or } I = A \times q.$$

The current density A varies considerably, depending upon capacity and speed, and is, from a designer's

*"Analysis of Design-Constant Curves," ELECTRICAL WORLD, July 21, 1917, page 103.

†In Fig. 1 D represents the back bore, or the outside diameter, of the stator punchings.

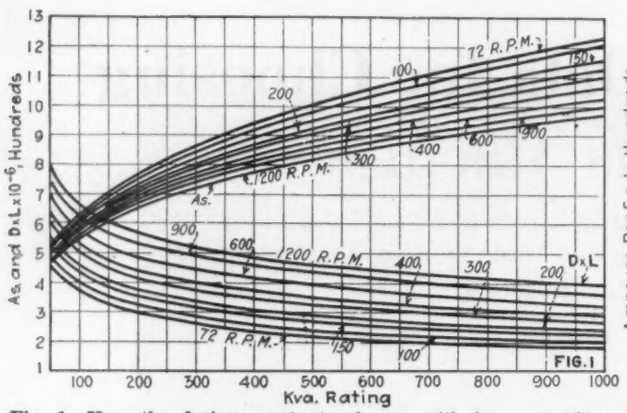


Fig. 1—How the design constants change with kva. capacity and speed for symmetrically designed machines. These curves as well as those which follow refer to 60-cycle machines.

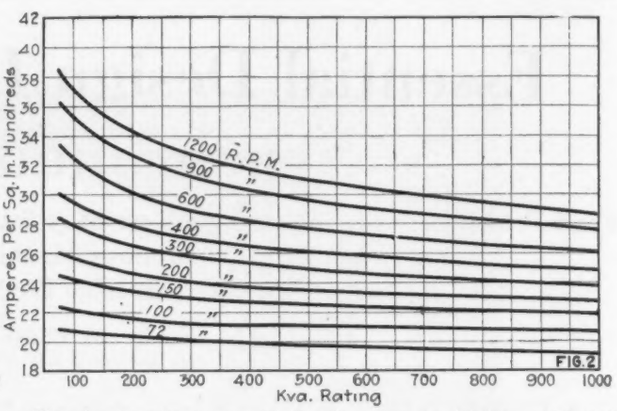


Fig. 2—Armature current density may be higher with high speed for same kva.; also, for same speed, current density may be higher in small kva. ratings.

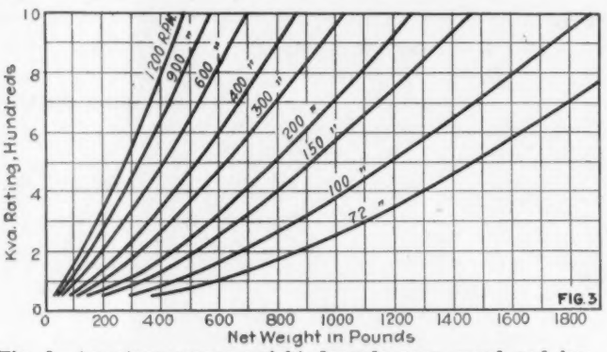


Fig. 3—Armature copper weight depends upon speed and kva.

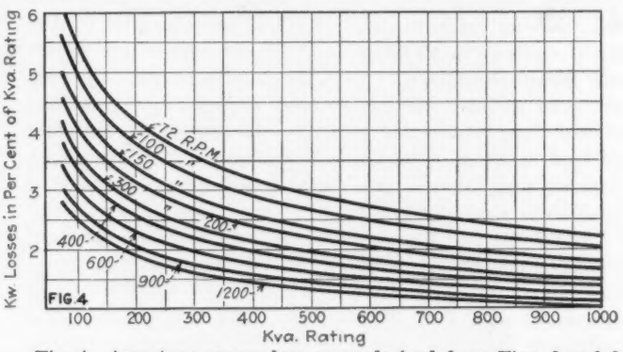


Fig. 4—Armature copper loss curve derived from Figs. 2 and 3.

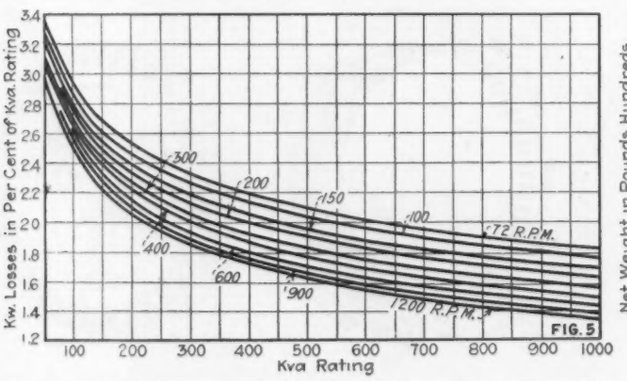


Fig. 5—Percentage of core loss for kva. rating and speed variation. Curves are somewhat pessimistic.

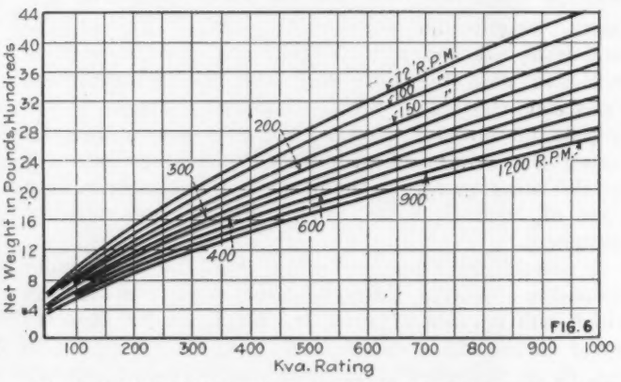


Fig. 6—Weight of stator iron required for synchronous machines, showing economy in high speed and high ratings.

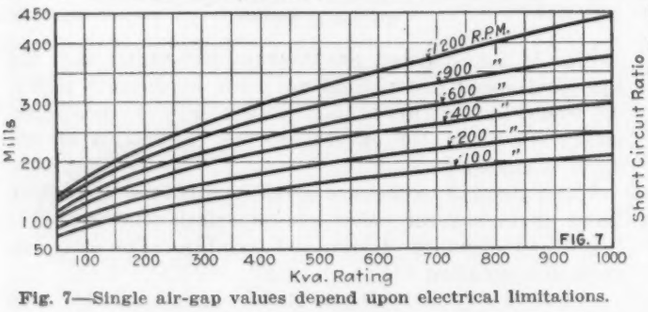


Fig. 7—Single air-gap values depend upon electrical limitations.

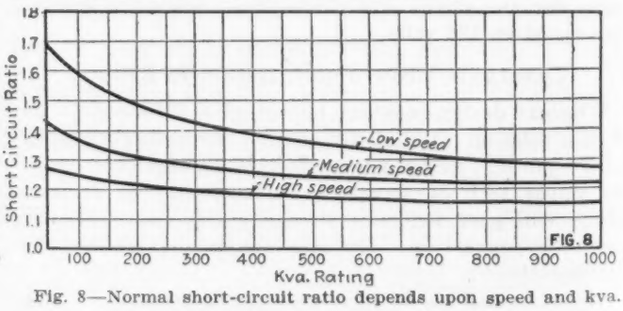


Fig. 8—Normal short-circuit ratio depends upon speed and kva.

FIGS. 1 TO 8—LOGICAL DEVELOPMENT OF ESSENTIAL DATA FOR 60-CYCLE SYNCHRONOUS MACHINES

viewpoint, determined by giving due consideration to heating, efficiency, ohmic drop and economy of actual copper. In high-speed machines the heating is largely the limiting feature; in low-speed machinery the efficiency and ohmic drop come more into consideration.

There exists a simple law or relation between current density, net copper weight and stator copper loss, as follows: If the total net weight of the bare stator copper (G) and also the current density in amperes per square inch of effective conductor (A) are known, then the stator copper losses (W), in watts, at 50 deg. C. rise of temperature may be determined:

$$W = 2.56 \times A^2 \times G \times 10^{-6}. \qquad (6)$$

This simple and convenient formula (6) is derived

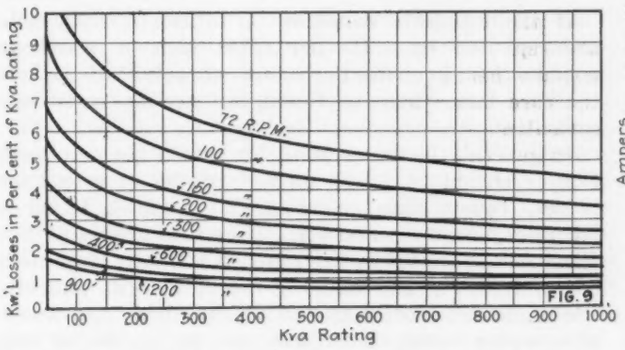


FIG. 9—EXCITATION LOSSES AT 80 PER CENT POWER FACTOR, INDICATING SIZE OF EXCITER REQUIRED

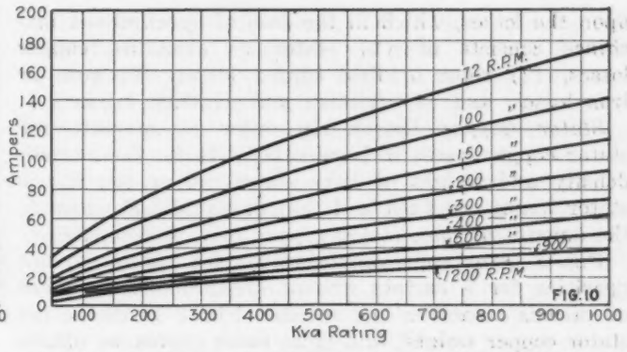


FIG. 10—NO-LOAD FIELD CURRENT TO OVERCOME RELUCTANCE OF AIR GAPS AND MAGNETIC CIRCUIT

as follows: If l is the total length in inches of effective stator conductors, and q the area in square inches of effective conductor, then the resistance in ohms at 25 deg. C. is:

$$R = l/(q \times 1.45 \times 10^6).$$

If I denotes current in the conductor (in case of a three-phase, Y-connected or two-phase open-type winding, also "current per terminal"), then:

$I = A \times q$, and by substituting:

$W = I^2 \times R$

$= A^2 \times [(l \times q)/(1.45 \times 10^6)]$ watts.

Since the total net stator copper weight is:

$G = l \times q \times 0.32$,

$W = A^2 \times G/(1.45 \times 0.32 \times 10^6)$

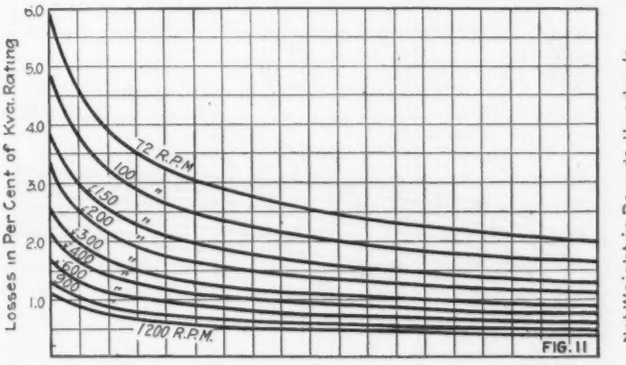
$= 2.16 \times A^2 \times G \times 10^{-6}$ watts.

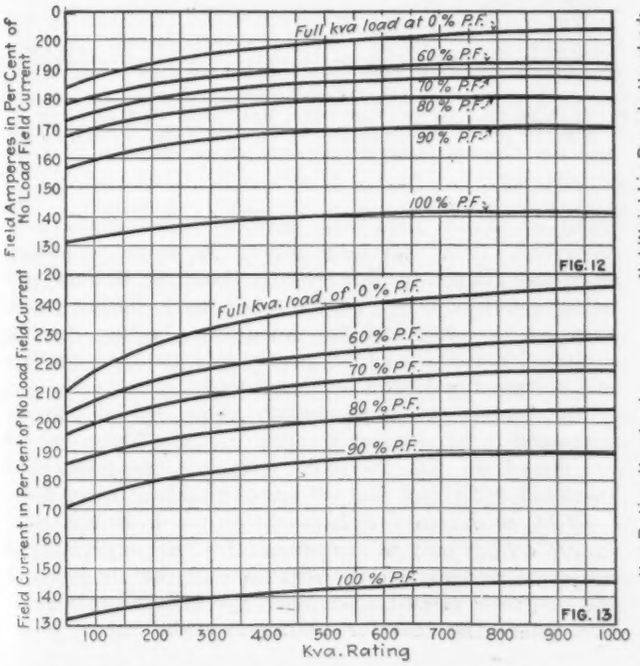
at 25 deg. C. temperature, or at 50 deg. C. temperature we obtain:

$W = 1.19 \times 2.16 \times A^2 \times G \times 10^{-6}$ watts,

$= 2.56 \times A^2 \times G \times 10^{-6}$ watts.

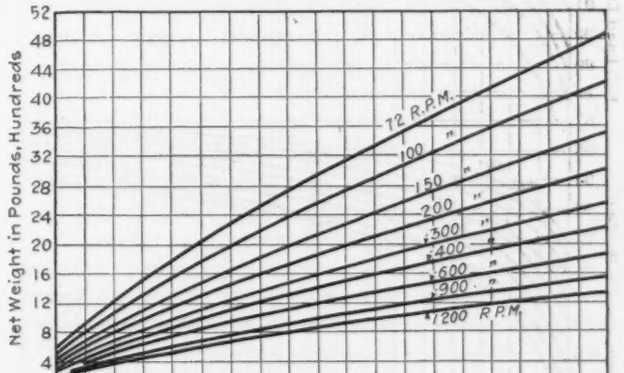
The efficiency of a certain line necessarily depends

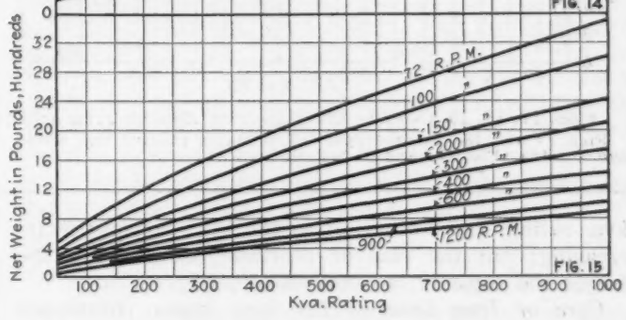


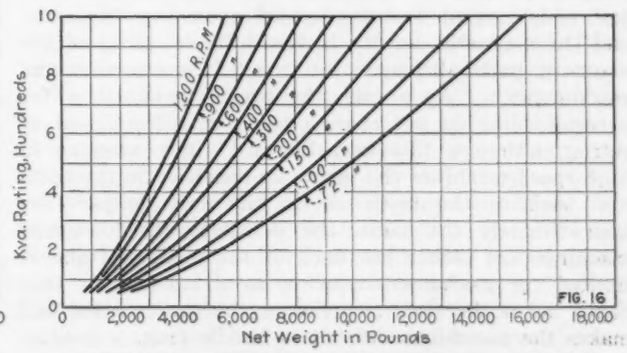

Field Amperes in Per Cent of No Load Field Current
Full kva load at 0% P.F.
60 % P.F.
70 % P.F.
80 % P.F.
90 % P.F.
100 % P.F.
FIG. 12
Field Current in Per Cent of No Load Field Current
Full kva. load of 0 % P.F.
60 % P.F.
70 % P.F.
80 % P.F.
90 % P.F.
100 % P.F.
Kva. Rating
FIG. 13

FIELD LOSSES AND EXCITATION CHARACTERISTICS

Fig. 11—Field losses at 100 per cent power factor.
Figs. 12 and 13—Excitation at various lagging power factors for machines at high (Fig. 12) and low (Fig. 13) speeds.







CALCULATING EFFECTIVE IRON AND COPPER WEIGHTS

Fig. 14—Weight of field pole punchings.
Fig. 15—Net weight of field copper.
Fig. 16—Total effective iron and copper weights.

upon the losses, which in the case of synchronous machines consists of (1) stator or armature copper losses, (2) rotor or field copper losses, (3) core or iron losses, and (4) friction and windage losses.

Stator Copper Losses.—In order to compute the stator copper losses it is necesssary to fix the current density and weight of bare stator copper, or, if the stator losses are fixed and the current density known, the amount of bare stator copper may be computed.

Fig. 2 gives approximate values for stator current densities for a certain line of synchronous machines of various capacities and speeds. Fig. 3 gives the net stator copper weight, and from these curves we obtain the stator copper losses as shown in Fig. 4. It is interesting to note that for a 100-kva. rated machine, the stator copper losses will vary from 5.5 kw. at 72 r.p.m. to 2.5 kw. at 1,200 r.p.m. The values for stator copper losses, however, as expressed in percentage of normal kva. rating, are decreasing as the kva. capacity is increasing; but the rate of decrease becomes less the larger the capacity, as indicated in Fig. 4.

Core or Iron Losses.—The iron losses (hysteresis and eddy-current losses) depend upon the frequency and the magnetic density in the different parts of the magnetic path, also upon the type of construction and workmanship. As a rule, the magnetic densities for a certain line do not change much with the speed or rating, although this may be said: that whereas in high-speed machines the magnetic densities in the teeth and back of the teeth—or in the core proper—are approximately the same, the densities for low-speed machines are rather low back of the teeth and almost limited for mechanical reasons, as a too shallow iron depth below the slots complicates the construction and makes the punchings difficult to handle from a production standpoint. The densities in the teeth, however, are, on the other hand, chosen rather high.

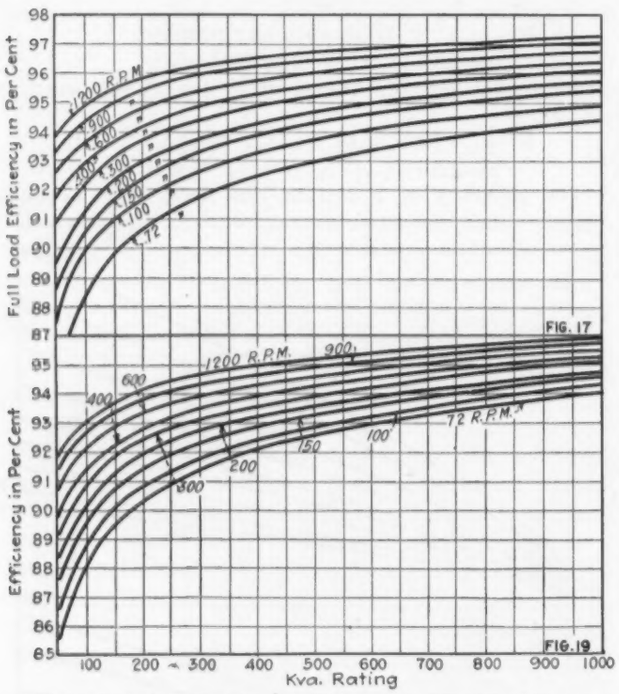
If the magnetic densities for different frequencies are replotted in watts per cubic inch or watts per pound—then, knowing the volume or weight of the iron, the core losses may be found for various speeds and capacities.

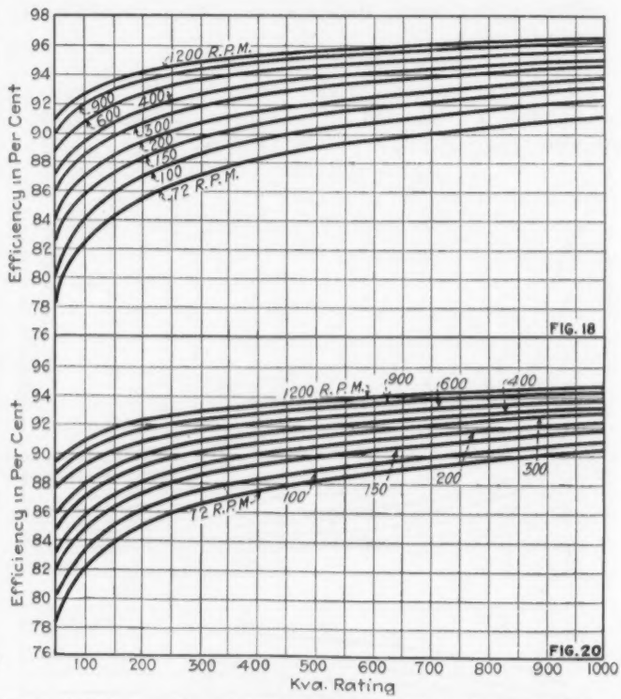
In general, the curves used for computing core losses are, or should be, based on test results of actual machines, rather than on magnetic densities based on laboratory research and tests of certain grades of iron. Time and again it has been proved that the shop methods of handling and building the cores—*i.e.*, punching the segments, insulating and drying them, and assembling—play a very important part in the useful magnetic curves for computing core losses.

It is, therefore, true that every factory has or should have, so to say, its own set of curves based on their own methods and construction. In connection with this it is well to mention that excessive, or even moderate, filing of stator slots will vary the core losses considerably. It is, therefore, a very bad policy to design slots too closely in this respect, because it does not better conditions, but, on the other hand, throws hardships on the shop and the production, besides getting an inferior machine as far as core loss and core heating and voltage breakdown are concerned.

Fig. 5 gives rather pessimistic values for core losses expressed in per cent of the kva. rating. These curves are based on No. 26 gage iron, not annealed, but insulated with one coat of core-insulating compound.

Field or Excitation Losses.—At no load the field excitation has only to compensate for the ampere-turns necessary to overcome the reluctance of the air gap and the magnetic circuit. At loads the synchronous reaction enters and calls for additional excitation.‡





FIGS. 17, 18, 19 AND 20—EFFICIENCY OF ENGINE TYPE AND TWO-BEARING TYPE OF SYNCHRONOUS MACHINES AT FULL LOAD

Figs. 17 and 18—Engine-type, not including friction and windage, for 100 (Fig. 17) and 80 per cent power factor.

Figs. 19 and 20—Two-bearing-type for 100 (Fig. 19) and 80 per cent power factor. Low power factor lowers efficiency.

‡A detailed discussion of this was published by the writer, "The Excitation of Synchronous Machines," ELECTRICAL WORLD, Feb. 12, 1916.

As the air gap of a synchronous machine is electrically limited, and not, as is the case with induction motors, mechanically limited, the air gap varies over a wide range, depending upon capacity and speed.

The field design in most cases will have to adapt itself to mechanical limitations and the necessary margin as to heating limits. More turns mean more copper and heavier field coils, but again a smaller exciter and a cooler field. The arrangement of turns and layers and the cross-section of the coil also enters into consideration. For a given line of synchronous machines it is usually more difficult to meet conditions involved with high speed than the characteristics of low-speed machines.

Fig. 9 gives the values for necessary exciter capacities, expressed in percentage of the kva. rating for the line under discussion, and may serve as a fair estimate concerning the size of exciter required.

Figs. 12 and 13 give the approximate field excitation expressed in percentage of no-load field amperes at various lagging power factors of high-speed and low-speed synchronous machines, but it should be kept in mind that exciter capacities as given in Fig. 9 refer to operation at full load, 80 per cent power factor only.

Fig. 14 shows approximate net weight of the field iron, that is, the net weight of the pole punchings, and Fig. 15 the approximate net weight of field copper. Total copper weights may readily be derived by adding data from Figs. 3 and 15, while total iron weights may likewise be obtained from Figs. 6 and 14. Fig. 16 represents the total weight of effective material, that is, total weight of armature and field punchings and copper.

For engine-type machines all losses are included with the exception of windage and friction losses. For other types of machines—that is, other than engine-type—friction and windage are usually included in the total losses for computing the efficiencies.

The total weights of machines may be estimated by adding weights of parts for different types to the weights of effective materials. This matter will be discussed in an early issue.

Arrested Development of Public Utilities

Part Which Electric Power Must Play in Bringing About Renewed Industrial Progress in the Nation—Necessity for State Regulation—Financial Problems Awaiting Solution

By EDWARD N. HURLEY*
Chairman of the Board, Hurley Machine Company

AMERICA today is at the crossroads of electrical development. It is a question whether we are to go forward or stand still. At this very moment the electrical industry is suffering from arrested development. The industry is awaiting the verdict of the American people. I have taken the electrical industry as my topic because I believe that there is no question, save the daily problem of food, clothing and shelter, which is so vital to the welfare of the American people. Upon the development of the electrical industry depend the extension of means of communication, further facilities for lighting and household conveniences, the spread of education, and the further progress of civilization.

We like to think of ourselves here in America as the pioneers in the science of electricity. We have been the pioneers, but the job we started has not been half done. There are still 14,000,000 homes in the United States without electric service and which eventually will have it. It is authentically stated that if the present problem of housing the population is to be met, the United States needs 1,500,000 additional homes, 500,000 additional factories, 5,000 public schools, 5,000 churches, 60,000 apartment buildings and 15,000 theaters. These, too, mean electric service. There are 150,000 pending applications for power by existing or new industrial plants desirous of utilizing electricity.

We have come to think of electric light as the normal lighting for every home. We like to think that the women of the nation are no longer compelled to do the drudgery of the home—that electric power has taken a large part of the load from their backs. The fact is that the vast majority of people in the United States are still without the aid of electric energy. There are literally millions who still read under smoky oil lamps. There are many industries burning coal and generating their own power which, more economically, could utilize electricity from the electric light and power plant and at the same time decrease the drain upon the nation's coal pile.

"Do it electrically" is a slogan which has been much in use lately, but it cannot reach its full meaning until a way has been found to provide the enormous amount of money necessary to build additions to old plants and for the construction of new ones which will provide light and power for the homes and factories still in semi-darkness and lacking in the economical facilities for operation afforded by electric power.

ELECTRIC POWER AN INTERSTATE PROBLEM

The electrical industry, if it is to be operated economically, must be operated in large units—the larger the unit the greater the economy. Existing small units serving individual communities must be physically interconnected to permit of more economical use of present generating capacity and with the ultimate purpose of building a single great unit to replace the smaller ones as they become obsolescent. And unless these great stations at the very beginning are built with a realization of what will be required of them ten and twenty years hence, much of the machinery will have to be torn out and replaced, and, perhaps, even, buildings will have to be remodeled or replaced at tremendous expense as the years go on.

Electric power has ceased to be a local problem. It has become a state-wide and even an interstate problem. Steam and hydro-electric plants built in large

*Address delivered before the Chamber of Commerce of the United States at Atlantic City, N. J., April 29; slightly condensed.

units now provide service over a radius of 100 miles or more, and in many cases their lines extend far beyond state boundaries.

The old method of financing has no bearing whatever upon the utility questions of today. Under modern methods of regulation, as provided by the utility laws of most of our states, overcapitalization and watered stock are practically obsolete terms. Capitalization has nothing to do with the rates paid by the customers of utility companies. Capitalization is not even considered when state public service commissions make the rates.

It is true that the rates of the electrical industry are regulated by law. The returns on the capital invested are thus limited. Frequently they are not sufficient to encourage capital to go in. Those who complain on this score against state regulatory bodies are simply leveling their shafts at the wrong target.

PUBLIC OFFICIALS RESPONSIVE TO PUBLIC OPINION

Public officials are usually responsive to public opinion. This is a democratic country and it is governed democratically. Appointed officials as well as those who are elected take it for granted that the public has common sense as well as a sense of fairness. And the public is always fair when it has full information. When the public takes an unfair attitude toward an industry it is almost invariably because accurate information is lacking. It behooves the electrical industry everywhere to take the public into its confidence. No company official has the right to sit behind closed doors and complain about unfair treatment. The public will not understand the difficulties of the industry unless the industry throws open the doors and tells the truth about itself plainly and without fear. The newspapers like to get their information from the head of a corporation—the man who is really responsible. If the captains in the electrical industry would make themselves more available, there would be less misunderstanding of their troubles and their plans for development.

If the proper encouragement is given to the electric light and power industry, the industry will spring forward in the next decade faster even than in the past decade. The result unquestionably will be a lowering of the cost of living and the conservation of national resources which cannot fail to benefit the whole population. I think it will be agreed that upon the development and application of electrical energy, more than upon any other one thing, are dependent both the speeding up of production and the conservation of our natural resources.

The almost unlimited water power of the nation cannot be harnessed for the benefit of the public without enormous capital investment. Already there are 1,450,000 thrifty American citizens who have put their savings into the securities of the electric light and power industry, and there are millions more who may be listed as indirect investors through the banks and insurance companies. They already have invested five billion dollars, and billions more must be forthcoming if the complete job of the electrical industry is to be done.

It is not merely in the cities but on the farms that more progress must be made. There are 6,500,000 families living on "farms" in this country. The lives of 2,000,000 of these families have been made less burdensome by the introduction of electricity, but the convenience must still be extended to the vast majority which remains unserved.

In reviewing the development of electricity there are very few of us who really appreciate the wonderful work done by that great inventor who has accomplished so much not only for the industrial world but for mankind generally, Thomas A. Edison; by C. A. Coffin, chairman of the board of the General Electric Company, who co-operated with Edison in developing the manufacture of electrical devices; by George Westinghouse, whose vision and foresight built the Westinghouse Electric & Manufacturing Company, or by Samuel Insull, former associate of Thomas A. Edison and recognized today as the foremost leader in the central-station field in America. These men and others have shown what brains, vision and courage can do in expanding a great industry, with the result that America today uses more electricity than all the rest of the world combined, and many times as much per capita.

THE DEVELOPMENT OF ELECTRICITY

In the early and competitive development of the electrical industry methods were employed by some managers which were not consistent with good business ethics. In some cases more attention was given to the selfish interest of the corporations than to public needs, with the result that in a number of communities a chaotic condition developed. Local politics and prejudices often entered into the settlement of utility questions, and expert advice on engineering, valuation, accounting, rates and service counted for little. This condition left the service-using public helpless against poor and inadequate service and against unjust rates. This method of control, like any commercial project not based on costs, resulted in poor service where rates were too low and in extravagance and corruption where rates were too high. In either case the public failed to get what is now looked upon as an essential—good and adequate service at a fair rate. Cities and villages found that if, individually, they attempted to regulate rates of service, each necessarily would be forced to create staffs of highly skilled and highly paid experts and that there would ensue constant conflict of practices and principles between the expert staffs of the various municipalities.

In the absence of proper regulation there are some communities even today in which utility companies are attempting to ride roughshod over their patrons and the public, or where the public, through lack of understanding of its own self-interest in the prosperity and well-being of the utilities, is refusing them fair treatment, or even endeavoring to wreck them.

Not all the companies really understand what service means—real service—using the word in its broadest sense. Such real service commences at the top of the company and works down and percolates through to the outer edges of the corporation, so that all points of contact are guarded and all methods of intercourse are watched, and the consumer is considered in the manner which makes him believe he is regarded as an individual with rights and desires which the company recognizes and respects.

The system of state regulation by commissions now in effect in forty-two states is the natural and logical outgrowth of the attempt to remedy the obvious and unbearable faults of the old system. Statistical data have been compiled by the commissions regarding the capital invested in the electric lighting and street-

railway companies. All questions of valuations, depreciation, etc., are under their control. They have at hand every detail as to how the properties are financed and what the earnings are. Every fact and figure is before them. Is there any valid reason why a definite policy should not be outlined for the many electric light and street-railway companies that are being seriously delayed in obtaining permission to expand and to improve their service to the public? The large majority of the state commissions consist of men with courage and a knowledge of the public's requirements. But in a few states there are members of commissions who are still resorting to the old political methods of handling cases brought before them. The public should be the first to rebuke such policies, as it is the public which always suffers as a result.

In the early days of the electrical industry and in the absence of collective facts, unwarranted attacks upon a public utility might be overlooked. But today, with all the necessary data before both the people and the state commissions, it is impossible to expect progress where charges are made with ulterior motives.

Financial Problems

The financial standing of a well-managed street railway, gas or electric lighting plant is as vital to the life and development of a community as its banks, and should be protected against unfair attacks so that customers and the investing public will have confidence in the properties, resulting in a desire to purchase utility securities when offered. The American people must realize that confidence in public utility securities cannot be had by constant, unjust criticism. If the same kind of public attack should be made upon national and state banks in the same communities where members of state commissions and other public officials are now bitterly assailing the central stations and street-railway companies, the public would lose confidence and in a very short period these banks would be forced to close their doors.

No public utility corporation subject to regulation can finance its requirements out of earnings. For each dollar of additional annual gross revenue from the sale of electrical energy by a light and power company it is necessary to provide additional facilities involving an investment of from $4 to $6. Thus a company with a gross revenue of, say, $1,000,000 per year, to provide for a growth of 10 per cent per annum ($100,000), which is a very moderate rate, would have to spend $400,000 to $600,000 for additional generating capacity and distribution facilities. With earnings limited by commission regulation to 8 per cent on the invested property value, which is below the actual cost of obtaining capital, it will be readily seen that additional capital must be secured if the facilities are to be provided to enable the growing service requirements of the community to be met, and such capital can be obtained only if a reasonable, permanent return is assured to the public utility concerned.

Therefore, adequate facilities for the transportation, lighting and industrial requirements of a growing community can be made available only if the attitude of the public and of the commission authorities toward the electric enterprise is such as to encourage the necessary capital investment and to afford it the security as to principal and return without which the investor will refuse to become interested in the situation. When financing, companies are compelled to make provisions for ample reservations, so that today public utility securities with substantial reserves are gilt-edged.

The "public be damned" policy in public utility companies has been virtually eliminated. We may find some of the old methods in force in certain rural towns, but modern managers now "sell" the public needs to their employees when those employees first enter the service, and then keep them informed as to anticipated requirements. This is good business. The public is entitled to 100 per cent service, and we have hundreds of public utility organizations that are giving it; but unfortunately the public is reluctant to commend their efforts, since the people find difficulty in differentiating between the many good companies that give adequate service and those that are inefficient and indifferent.

Unless the public, the state commissions and the utility corporations work together and create that confidence which will influence people to invest in utility securities, I am convinced that the nation within three years will fall so far behind in electrical development that it will be without sufficient electricity to provide for electrical home labor-saving devices, for unless capital investment can be encouraged through the creation of this confidence, the expansion of our industries will be seriously retarded.

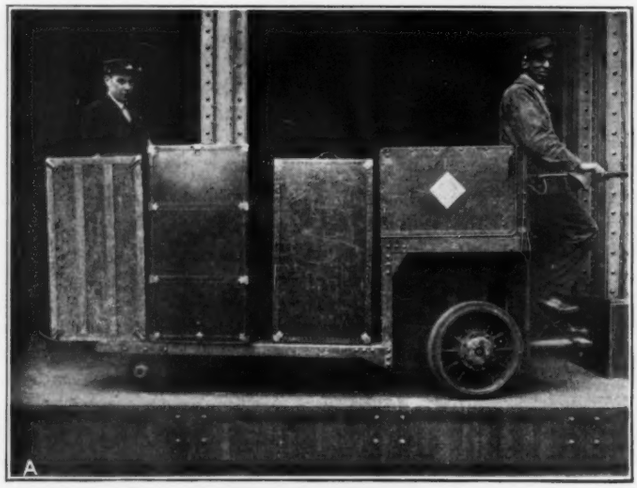
Government Ownership or Private Ownership

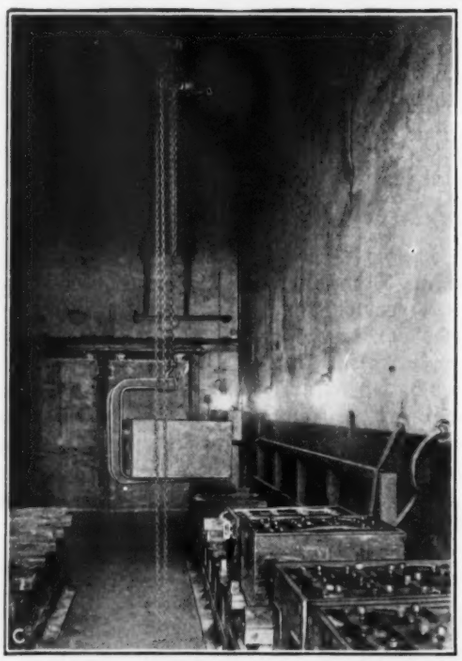
Although at one time sympathetic toward government ownership, I am certain, after a number of years in government service, that no community can receive the industrial service to which it is entitled under municipal or governmental management. It is not humanly possible to obtain the same effort or interest from managers or men employed in industrial government service that exists in competitive private ownership, and as a result, if the advocates of government ownership investigate the facts carefully and impartially, they will find that government operation in industrial service is a flat failure from a "service to the public" standpoint. This is true not only in America but it is a proved fact throughout the world.

The public has difficulty in unraveling the bookkeeping through which the actual deficits in municipal operations are finally placed upon the people through the medium of the tax rates themselves. It is therefore of primary importance to the taxpayer, where municipal operation of the public utility is suggested, that such a bookkeeping system shall be set up as will give the taxpayer a true picture of the actual operation and cost thereof. When this is done, I am convinced that it will be found that the lack of personal efficiency under municipal or governmental industrial ownership spells financial failure for the enterprise.

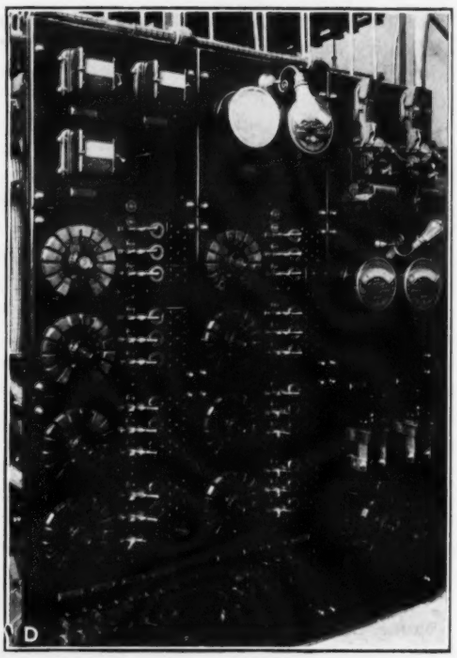
If the members of the Chamber of Commerce of the United States of America, with their great power and influence, were to take a keen personal interest in public utilities in their respective states, insisting that justice be given the public and the utilities, a permanent step toward solving this most important problem would be taken.

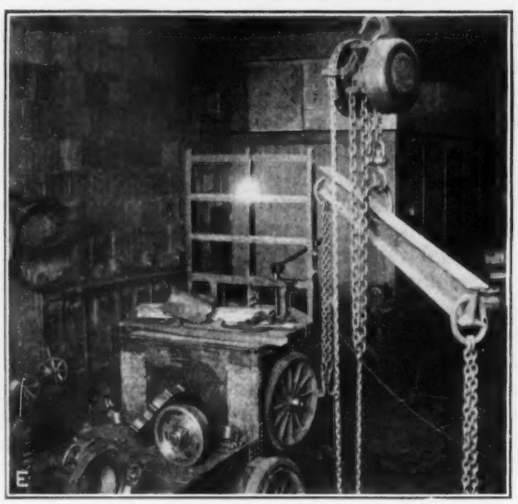
When public utilities realize what high-grade service means and what effect such a service in its operation has upon its customers and the public, then the question of municipal or governmental ownership will gradually drop into the background and the public recognition of the difficulties and the need for encouragement and liberality will quickly aid in the solution of this national problem.

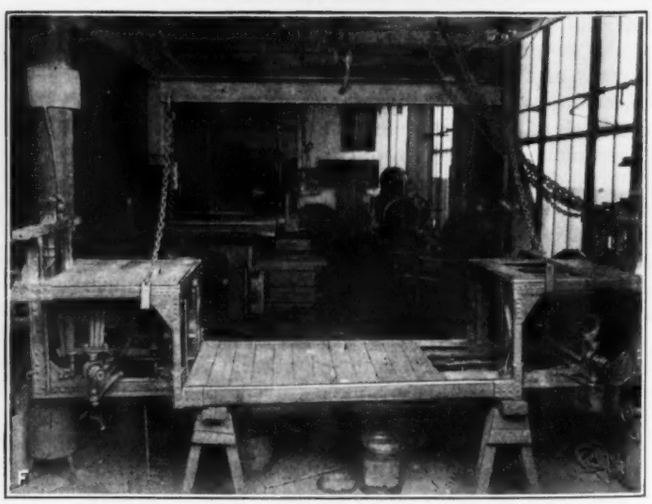




Industrial Trucks Handle Baggage at Low Cost







A—Drop-frame industrial truck used for hauling baggage to and from the trains.

B—Smaller type of truck for hauling baggage between the incoming and outgoing baggage rooms.

C—A special type of sling is used for taking the batteries out of the trucks and placing them on the charging bench.

D—The batteries are charged three in series and a variable resistance permits regulating the charging current. If any one battery comes up to charge before the others, it may be cut out and an equivalent resistance inserted.

E—A corner of the maintenance repair shop where the trucks are run in monthly for inspection and minor repairs.

F—After the truck has been in operation for two years it is entirely overhauled at the main repair shop.

Electric Trucks Prove Indispensable in Handling Baggage

Work at Grand Central Terminal Is Done at Low Cost with Industrial Trucks—Methods of Operating and Maintaining Equipment—Batteries Are Changed Instead of Holding Trucks for Charging—Costs per Truck-Mile and Truck-Month

FROM the experience which the New York Central Railroad has had with industrial electric trucks for handling baggage, mail and express in the Grand Central Terminal, New York City, it has been found that one truck of this type will handle work that formerly required five hand trucks. Besides the actual decrease in the cost of handling material, many other advantages have been found in the use of this equipment. For instance, avoidance of congestion is an important item, since more than 200 hand trucks would be required for the work now handled by about forty electric trucks. In addition, increased speed of operation has not only reduced the labor cost but has permitted moving the baggage and mail more closely in conformity with the scheduled departure of trains. Rush work, such as the placing of late baggage or mail on a train, can also be taken care of to much better advantage than with hand equipment. Another rather important point has been the increased efficiency of labor for unloading purposes due to the reduction of the physical exertion required in the moving of material. When a loaded truck arrives at its destination the operator is not fatigued, as was formerly the case, and is able to remove the load at a higher rate of speed. Taking everything into consideration, it is doubtful if the terminal could be operated as efficiently or as smoothly by the former method, regardless of the number of men employed.

The first electric trucks were placed in operation at this terminal early in 1911, and it is rather interesting to note that these trucks are still in good condition and operating daily. One unit of this original equipment was recently placed on exhibition at the New York Edison Electric Vehicle Show to indicate the results which may be expected if proper care is taken of such apparatus. Owing to the good results which were shown by this initial installation, it was decided to add more trucks, and in April, 1911, there were ten units in operation. In 1912 there were twenty trucks in regular operation, and in 1913 the fleet had been increased to thirty.

A study of the operating results over this period of years showed that the total cost of labor and other items had risen 12.8 per cent, while the volume of baggage and mail handled had increased 46.5 per cent. The cost of handling material was, however, reduced 23.1 per cent. These figures took into consideration all items which should be charged to the electric truck, such as maintenance and overhead. As the years went by and more trucks were added, and labor and other costs rapidly increased, the results were even more marked, until at the present time the method of handling is considered indispensable.

There are now forty-six trucks of the drop-frame type in operation. They are rated at 4,000 lb. (1,814 kg.) capacity, with a motor rating of 2½ hp. and a twelve-cell, fifteen-plate, 196-amp.-hr. vehicle-type lead battery. There are also five freight-type trucks of the same capacity and using the same battery and motor equipment. Although several makes of batteries are used, they are interchangeable.

The drop-frame-type trucks are used for carrying baggage to and from trains, while the smaller or freight-type trucks are used to handle baggage between the incoming and outgoing baggage rooms. The usual number of pieces of baggage handled every twenty-four hours is 6,000, although the maximum has been as high as 12,000. Besides this baggage-handling work, there is also mail and miscellaneous package work. As elevators are used for moving the trucks to the different levels, the service, as far as grades are concerned, is not severe.

Before a man is classed as a truck operator, he is instructed in the operating details, such as steering, starting and stopping, by one of the experienced men. The new operator is also instructed that if anything appears to be in poor operating condition, the truck is to be turned into the maintenance repair shop. Before the new operator is finally intrusted with a truck, one of the baggage foremen goes with him on several trips and then passes on his competency.

Proper Maintenance Work Considered Very Important

To get the maximum working value out of the industrial trucks, as in any other piece of equipment, it is necessary that their operation be looked after very carefully. This is particularly true at the Grand Central Terminal, where trucks are operated on a twenty-four-hour basis and are not laid up for charging. Instead of bringing the truck in and keeping it out of service for charging, the battery is removed and a fully charged battery substituted.

For the purpose of maintaining the equipment in good operating condition the trucks are called in periodically for a close inspection. This is usually done monthly in what is known as the maintenance repair shop. As shown in the accompanying illustration, this is a small shop accommodating about three trucks at a time and equipped only for comparatively minor repairs. There are a workbench, a hoist and the usual assortment of bench tools. When a truck is brought in it is raised and placed on wooden horses so that all parts can be easily inspected.

The particular points in this inspection are to see that there is no lost motion in the brakes, steering gear or control. Brakes are tightened up at this time and brake bands renewed if necessary. It has been found that the lining must be renewed about every four or five years. If oil gets into the brake housing, however, the bands require renewing more frequently. As the

differential is packed with grease, there is not apt to be much trouble experienced from this source. However, in time the grease reaches a condition very nearly of the fluidity of oil and is then apt to give trouble.

As the drop-frame trucks have double-end control, there is likely to be some lost motion in the mechanism owing to the length of the rods and wearing of pins. This play is taken up at the time of inspection. The controller is also gone over carefully, and any lost motion is taken up and fingers that may be in bad condition are renewed. Occasionally it is necessary to replace a broken floor board, and this can be attended to at the same time. A log book of these inspections and repairs is kept by the inspector.

HEAVY REPAIRS ARE TAKEN CARE OF AT CENTRAL SHOP

It has been found a good operating practice to overhaul the trucks completely every two years, and this is done at a central shop where machine tools are available. The truck is entirely dismantled and all loose rivets are removed and new ones replaced. The frames are straightened, if necessary, and all moving parts are overhauled or renewed. A very careful inspection of the motors takes place, and armatures are thoroughly cleaned, receive a coat of baking varnish and are thoroughly baked. The field coils are also treated in the same way.

COST PER TRUCK-MILE FOR MAINTENANCE

	1918	1919
Mechanical labor and material	$0.0721	$0.0939
Electrical labor and material	.0810	.0956
Wood repairs and painting, labor and material	0162	.0180
Charging current	.0182	.0138
Battery repairs and renewals	.0657	.0419
Total	$0.2532	$0.2632

SUMMARY

	1919	1918	1914
Truck-months for year	516	516	421.5
Truck-miles for year	98425.8	64457.4	62412.6
Cost per truck-month	$50.22	$41.46	$21.73
Cost per truck-mile	$0.263	$0.253	$0.147
Charging current, kw.-hr.	73,453.	89,539.	70,742.

FIXED CHARGES, MAINTENANCE AND OPERATION

	Cost per Truck-Mile			Cost per Truck-Month		
	1919	1918	1914	1919	1918	1914
Fixed charges	$0.139	$0.162	$0.180	$26.60	$26.60	$26.60
Maintenance and charging current	.263	.253	.147	50.22	41.46	21.73
Operator	.318	.370	.255	.....	.....	.....
Total	$0.720	$0.785	$0.582	$76.82*	$68.06*	$48.33*

*Without operator charge.

BATTERIES ARE CHANGED INSTEAD OF HOLDING TRUCKS FOR CHARGING

As previously mentioned, the trucks are not kept out of service during the time required for charging the batteries, but instead a fully charged battery replaces the one which is depleted. This changing of batteries is done on a definite scheduled basis, each truck having its battery renewed every forty-eight hours. While it is evident that all batteries would not be equally discharged, nevertheless it has been found good practice to handle the work in this way rather than to renew a battery when an ampere-hour meter shows that it is very nearly discharged. As the operators are not especially skilled, it has been found that better results can be obtained by changing the batteries on a definite schedule than by leaving the proper time to their judgment. No instruments are used on these trucks with the exception of an odometer for recording mileage. There are fifty-one trucks in operation, and the work is so divided that twelve or thirteen batteries are changed every twelve hours.

As the available energy supply for charging is a 240-volt, three-wire system, the batteries are charged on two racks, three in series on each leg. By this arrangement a 120-volt supply is available for each leg, and as the three batteries in series require 31 volts each, or a total of 93 volts at full charge, the balance must be taken up in a variable resistance. The normal battery voltage is 24. It is possible by an arrangement of individual switches on the battery-charging panel to cut out any battery from the charging circuit and substitute an equivalent resistance. Such an arrangement allows the removal of a battery from the set of three being charged, if one of them requires less charging than the others. A charging rate of 40 amp. is used at the start, while the finishing rate is 15 amp.

Only minor repairs are made in the battery room, as all batteries are sent to the various manufacturers for overhauling. However, at least once a year the batteries are thoroughly cleaned and put in new crates. Several makes of batteries are in use, but the average life has been found to be twenty-seven months for this service. Seventeen spare sets are provided for handling the changing of batteries for the fifty-one trucks. A record of each battery is kept in the battery room by the individual number, which is given it on receipt of a battery. Records which are kept are "date new," "date cleaned," "date discarded" and a record of charging.

As shown in the accompanying illustration, the changing of batteries is facilitated by the use of a chain hoist with a special lifting hook. When a truck is run into the charging room the old battery is lifted out onto the charging rack and a fully charged battery is placed in the truck. Six men are required for the battery-room work, two being used on each eight-hour shift.

COST RECORDS ARE CAREFULLY MAINTAINED

As shown in the table, the operating cost for this equipment is very carefully kept. The costs are divided into three main groups, namely, fixed charge, maintenance and operation. For comparative purposes it has also been found advisable to finally reduce cost figures to a basis of truck-miles and truck-months. Costs per truck-mile are arrived at by dividing the various three divisions of costs by the miles operated. In arriving at the cost per truck-month the total truck-months are divided into the total cost for the three main items.

Fixed charges are made up of the usual items which enter into this cost, such as interest, insurance, taxes, depreciation on trucks and depreciation on charging facilities. The cost of tires and batteries is not, however, included in the fixed charges, but in maintenance.

It will be noted from the table that the fixed charges per truck per month have remained the same during the years 1914, 1918 and 1919, owing to the fact that virtually all of the trucks were purchased previous to the year 1914 and the various items were charged off at the same rate. The fixed charges on a basis of truck-miles, however, have decreased quite materially because of the fact that each year has seen the number of truck miles increase while the fixed charges remained the same. Maintenance costs are divided into five main divisions, namely, mechanical, electrical, wood repairs, charging current, battery renewals and repairs. For the year 1919 the maintenance cost was 26.3 cents per

truck-mile. The various items are still further subdivided in the records to show the actual cost of labor and of material for these various items. For instance, in 1919 the mechanical work was divided into a labor charge of $0.0805 and material $0.0134, making a total as shown in the table of $0.0939. A further division of the electrical work shows a labor charge of $0.0774 and a material charge of $0.0182, making a total of $0.0956. Wood repairs are made up of such items as replacing broken floor boards and repairs on the truck bodies. This item for the year 1919 was divided into a labor charge of $0.0152 and a material charge of $0.0028, making a total of $0.0180. There is, of course, no further subdivision of current and battery repairs and renewal charges. It will be noted that the cost of electrical labor is slightly lower than that of mechanical.

On a percentage basis these various items divided themselves as follows: Mechanical, 35.7 per cent; electrical, 36.4 per cent; wood repairs, 6.8 per cent; current, 5.2 per cent; battery repairs and renewals, 15.9 per cent.

Summarizing all of the costs, it may be said that the cost of operation was 72 cents per truck-mile for the year 1919, including every charge which could logically be placed against the equipment. In 1914 the same charge was 58.2 cents per truck-mile, showing in a very marked way the effect of present-day higher cost of operation due to increases in both material and labor expenses. Without any charge for the operator the cost of operating the trucks was $76.82 per month for each truck during the year 1919. In 1914 this same comparative expense was $48.33.

Inspection Placed on Scheduled Basis*

A Number Is Given to Each Job, and Inspections Are Scheduled Daily, Semi-weekly, Weekly, Triweekly, Monthly, Bimonthly, Trimonthly and Semi-annually According to Nature of Equipment

CONSIDERABLE attention has been given the subject of inspection and maintenance by the Syracuse (N. Y.) Lighting Company with a view toward placing this work on a definite basis. The inspection methods described have now been in successful operation several years on a system consisting of a steam station, a high-tension step-down substation and five distributing substations. The schedule includes inspections varying in their frequency from daily to semi-annually and covers virtually all apparatus in the stations.

As shown in Table I, a number is given to each job and identified by serial letter. The daily jobs carry the serial letter "D," the weekly jobs "W," triweekly jobs "T.W.," etc., and each station has its own series of numbers. The steam-station numbers are between 100 and 199, Fayette Street substation between 200 and 299, Solvay substation between 300 and 399, etc. For instance, "D-109" is a daily inspection at Fulton Street station, "W-201" is a weekly inspection at Fayette Street substation.

The charts are so arranged that the inspector can tell what he is to do each day. At the completion of his day's work a report (Fig. 1) is made out which indicates the inspections made and the defects noted. This report is turned in daily and the defects noted are indicated on the card shown. On the reverse side of the card shown in Fig. 1 are noted the repairs and replacements when completed. One or more of these cards are carried in a numerical file for each job in connection with which defects have been discovered. Inspections which show no defects are recorded only on the daily report sheet. If a job has been overlooked, a white slip is filled out calling attention to the omission and giving date when the inspection must be up to schedule, even should overtime be required to accomplish it. By this means the inspections are rarely more than twenty-four hours behind the schedule. In order to insure that the inspections occurring at infrequent intervals are not omitted, it has been found convenient to date them ahead in a year book which may be referred to from day to day.

It may be interesting to note that in 1918 and 1919 113 repairs were made at the time of inspection in cases where if the repairs had gone undone serious interruptions would probably have resulted. These defects were caught before grave trouble developed, and it is safe to say that without careful inspection a large percentage would not have been detected in time to prevent the failure of some particular piece of apparatus.

Previous to the introduction of the inspection work the night station troubleman was called on an average of two nights a week. The average number of calls in 1919 was approximately one every eleven nights. In other words, only one-third as many night trouble calls were recorded last year under periodic inspection.

Each central station requires its own scheme of inspection, but it is not going too far to state that systematic and regular inspection at stated intervals of time is a general principle at the foundation of good operating practice, for, like the proverbial ounce of prevention, it is more than worth the pound of cure. Periodic inspection of station and substation is good insurance.

Practice has generally leaned toward caring for only the pressing needs of each day. Inspection has been "incidental" and more often only "accidental" to the daily round. Much has been taken for granted as to the condition of equipment. Symptoms indicating the early stages of trouble are easily overlooked, and if discovered, repairs have been delayed until a more convenient time. Many such repairs have been classed as so-called "rainy-day-jobs," and under such operating conditions the men have frequently been compelled to drop regular work in order to repair a failure which might have been avoided by proper inspection. Even extensive use of reserve apparatus would not to any considerable extent reduce the number of interruptions under such conditions, and it is manifestly impossible to maintain spare equipment for all emergencies. To foresee is to forestall. The old lack of system should be

*This information was worked up in part by G. M. Parsons, now deceased, of the Syracuse Lighting Company, and is presented by courtesy of W. C. Pearce, superintendent of the electrical department of that company.

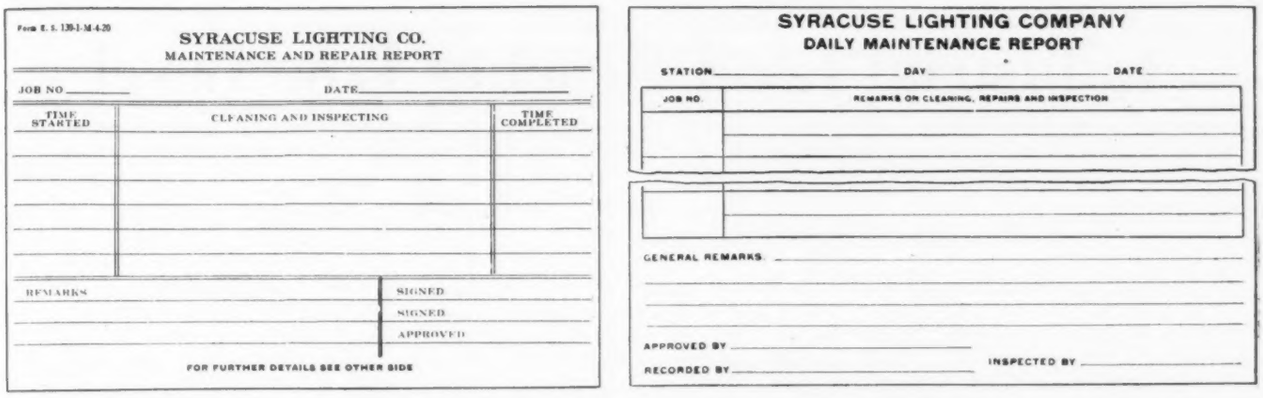
Table I—Arrangement of Inspection Schedules Designed to Facilitate Work and Prevent Overlooking Small Jobs

Week	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY
First	D100-D101-D102- D103-D104*-D105 D106-D107-D108- D109-D100-W111- SW100 Janitor M107-M108-M117 SA100 January and July SA105 June and December	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W106 M101-M109-M400	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W101-W102-W106 M102-M111-M400	D100-D101-D102- D103-D104**-D105- D106-D107-D108- D109- SW100 Janitor W103-W104-W113 M106-M112-M400	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W107-W108	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W105-W109-W110- W112	TW100 See last inspection SA101 June and December SA102 February and August SA301 May and October
Second	D100-D101-D102- D103-D104*-D105 D106-D107-D108- D109 SW100 Janitor W100-W111 M100 SA104 January and July	D100-D101-D102- D103-D104-D105- D106-D107-D108- D109 W106 M101-M110	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W101-W102-W106 M103	D100-D101-D102- D103-D104**- D105-D106-D107- D108-D109 SW100 Janitor W103-W104-W113 M106 SA103 January and July	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W107-W108 SA400 January and July	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W105-W109-W110- W112 TM103 January, April, etc. TM303 January, April, etc.	TW100 See last inspection
Third	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 SW100 Janitor W100-W111	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W106 M101	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W101-W102-W106 M104-M105	D100-D101-D102- D103-D104*- D105-D106-D107- D108-D109 W103-W104-W113 SW100 Janitor M500	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W107-W108 M401 April to October, inclusive	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W105-W109-W110- W112	TW 100 See last inspection TM100 January, April, July, etc. TM January, April, July, etc.
Fourth	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 SW100 Janitor W100-W111	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W106	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 M113-M118 BM-600 February, April, June, August, etc.	D100-D101-D102- D103-D104**-D105- D106-D107-D108- D109 SW100 Janitor W103-W104-W113 M114-M300 SA300 January and July	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W107-W108	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W105-W109-W110- W112	TW100 See last inspection
Fifth	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 SW100 Janitor W100-W111	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W106	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W101-W102-W106	D100-D101-D102- D103-D104* -D105- D106-D107-D108- D109 SW100 Janitor W103-W104-W113	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W107-W108	D100-D101-D102- D103-D104*-D105- D106-D107-D108- D109 W105-W109-W110- W112	TW100 See last inspection

Advisable Frequency of Inspection by Job Numbers

Job. No.	
	Daily
D-100	Inspect ratchet rheostats.
D-101	Test voltage regulators.
D-102	Inspect turbine and engine governor control.
D-103	Inspect station manholes.
D-104	Coal crane and conveyor—clean and inspect motors, controller and all auxiliaries—crane operator only. Thursday by electrician also.
D-105	Inspect and wipe exciters Nos. 4, 5, 6 and 7.
D-106	Inspect arc tubs.
D-107	Inspect 2,300-volt, 500-volt, exciter board and benchboard.
D-108	Renew burnt out lights back of 2,300-volt switchboard and 11,000-volt bus.
D-109	Inspect arc regulator, control, and secondary relay switch.
	Semi-weekly
SW-100	Fire apparatus—replace burned out red lights and see that all fire apparatus is in proper place—janitor.
	Weekly
W-100	Clean Nos. 4, 5, 6 and 7 exciters.
W-111	Inspect frequency changers and starting motors, brushes, rings and commutators.
W-106	Clean and repair motor generator sets.
W-101	Air compressor and motor—clean and repair.
W-102	Voltage regulators—examine for loose bolts, nuts and connections—oil all parts where needed.
W-103	Brush arc motors and machines, transformers—inspect and clean.
W-104	Battery charging set—inspect and clean.
W-105	Elevator—clean and repair motor and starting equipment, lights on elevator—examine fire apparatus in penthouse.
W-107	Storage battery—inspect connections and fluid level.
W-108	Fire alarm system—ring one round on each box—rewind and repair after 10 a.m. Friday.
W-109	Inspect arc boards, arc tubs and rectifiers.
W-110	Switchboard—clean front of board and switchboard gallery (operator).
W-112	Turbine No. 3—electrical inspection after 12 noon (special).
W-113	Subway feeder switches—inspect and clean.
	Triweekly
TW-100	Frequency changers—general inspection and cleaning.
TW-101	Clean and inspect 11,000-volt oil switches in switch house. Special—every six weeks—same day as TW-100.
	Monthly
M-100	Arc tubs—rectifier tanks and switchboard—clean.
M-101	Turbine No. 1—clean and inspect—first Tuesday. Turbine No. 2—clean and inspect—second Tuesday. Turbine No. 3—clean and inspect—third Tuesday.
M-102	11,000-volt lightning arresters—clean arresters and shed.
M-103	Machine shop motors, carpenter shop and garage—inspect and clean.
M-104	Step-bearing motor—clean.
M-105	Auxiliary motors—clean.
M-106	Engine No. 5—clean and inspect—first Thursday (wiper). No. 6—clean and inspect—first Thursday (wiper). No. 7—clean and inspect—second Thursday (wiper). No. 1—clean and inspect—second Thursday (wiper).
M-107	Regulators—clean regulators and all auxiliaries.
M-108	11,000-volt arresters—inspect and test electrolyte.
M-109	Ratchet rheostats—clean.
M-110	Inspect bell relay batteries.
M-111	Clean station manholes.
M-112	Station lighting—inspect all cabinets, fuses, etc.
M-113	Transformers for exciters, motor-generator set, auxiliary and station lighting, cleaning and inspection.
M-114	2,300-volt oil switches—clean.
M-117	Tirrill regulator—check setting.
M-118	2,300-volt and arc arresters—clean and inspect.
M-300	Solvay station—clean and inspect.
M-400	Substation inspection—E. Syracuse and Fayetteville—first Tuesday. Substation inspection—Camillus—first Wednesday. Substation inspection—Liverpool—first Thursday.
M-401	Lightning arresters in substations—inspect monthly April to October.
M-500	Inspect consumers' lightning arresters—April to October.
	Bimonthly
BM-600	Gas department—inspect lighting, switches, motor compensators. Make necessary repairs—February, April, June, etc.
	Trimonthly
TM-100	11,000-volt, 60-cycle transformer banks and wiring—clean January, April, etc.
TM-101	11,000-volt bus oil switches—clean.
TM-103	Test all 11,000-volt switches by tripping relays—second Saturday, January, April, etc.
TM-303	Test all 11,000-volt and 60,000-volt switches by tripping relays—second Saturday, January, etc.
	Semi-annual
SA-100	Test oil from transformers for exciters, auxiliaries, station lighting and arc machines—January and July.
SA-101	Change oil in frequency changers, motor-generator sets and Nos. 4, 5, 6 and 7 exciters—June and December.
SA-102	Change oil in machine oil switches—February and August.
SA-103	Test oil from feeder regulators—January and July.
SA-104	Test oil 11,000-volt, 60-cycle transformers January and July.
SA-105	Change oil in brush arc machine and motors—first Monday—January and December.
SA-300	Test oil—Solvay transformers January and July.
SA-301	Solvay substation, 60,000-volt and 11,000-volt apparatus, clean and repair—May and October.
SA-400	Test oil substation transformers—East Syracuse and Liverpool—January and July.
AS-500	Inspect transformer vaults.

* Crane operator only. ** Crane operator and electrician.



SYRACUSE LIGHTING CO.
MAINTENANCE AND REPAIR REPORT

JOB NO. _____ DATE _____

TIME STARTED	CLEANING AND INSPECTING	TIME COMPLETED

REMARKS

SIGNED

SIGNED

APPROVED

FOR FURTHER DETAILS SEE OTHER SIDE

SYRACUSE LIGHTING COMPANY
DAILY MAINTENANCE REPORT

STATION _____ DAY _____ DATE _____

JOB NO.	REMARKS ON CLEANING, REPAIRS AND INSPECTION

GENERAL REMARKS

APPROVED BY _____

RECORDED BY _____ INSPECTED BY _____

RECORD SYSTEMS ARE NECESSARY FOR THE PROPER ANALYZING OF TROUBLES TO REDUCE SERVICE INTERRUPTIONS

On the left is a maintenance and repair report. The back is the same as the front, with the exception that the heading "Repairs and Replacements" becomes "Cleaning and Inspecting." On the right is a "Daily Maintenance Report." These reports are entered on the maintenance and repair report if the information is considered valuable enough for permanent record.

superseded by a system of *prevision, provision* and *supervision.*

The first step in the problem is to realize the necessity of a plan of systematic inspection. In the second place, a carefully prepared time schedule of the details of the inspection should be laid out. Finally, the responsibility for carrying out the schedule must be placed in the hands of a competent person whose duty it must be to see that the inspections are made and duly reported. The men who are associated with him must be impressed with the fact that the work they have undertaken is important and must not be neglected.

The frequency of inspection on a given piece of apparatus can best be judged by asking the following questions: (1) How important is this piece of apparatus to the system? (2) Is it susceptible to frequent trouble? (3) Does its location permit frequent or infrequent inspections? (4) Does the system of operation permit an inspection without interruption? An analysis of these questions will usually determine how often it is necessary and practicable to inspect apparatus.

The first point, the importance of the apparatus to the system, may not be a deciding factor in determining the frequency of inspection, because the second point, susceptibility to trouble, might indicate that frequent inspections would be a waste of time. The fact that apparatus cannot be inspected without interruption of service is a point that often outweighs all others. It is sometimes possible to take care of such inspections at times of reduced load such as Sunday operation. By reference to Table I it will be noted that certain work is definitely scheduled for that day.

It has become increasingly evident during the last few years that station design should actually take into consideration the inspection schedules which will necessarily have to be adopted if the equipment is to be properly maintained. Spare capacity, transfer buses, ease of accessibility and many such points are very important considerations in design which later affect the inspection schedules.

However, a station as a rule must be taken as it stands and maintenance and inspection schemes must be arranged accordingly. For an old station it is possible to improve the maintenance problem by careful analysis of all troubles and the laying out of schedules as described.

The system employed by the Syracuse Lighting Company calls attention to the necessity for definite methods of inspection procedure in all central-station systems.

TABLE II—FREQUENCY OF INSPECTION VISITS FOR AN 11,000-VOLT STEP-DOWN SUBSTATION

This work is also scheduled by days as in Table I

DAILY

Inspect motor-driven rheostats.
Test feeder regulators.

WEEKLY

Inspect motor-driven rheostats and circuit breakers.
Clean feeder regulators.
Inspect feeder regulators, transfer bus and switches.
Clean battery-charging set.
Inspect battery-charging set.
Clean and inspect station auxiliary transformers and switchboard.
Clean and inspect storage batteries.
Clean and inspect arc tubs, rectifiers and arc switchboard.
Inspect arc tubs, rectifiers, arc switchboard and arc oil switches.
Inspect station manholes and subway.
Clean and inspect frequenc, changers.
Inspect frequenc changers.
Clean air compressor and motor.
Inspect air compressor and motor.
Inspect benchboard, 2,300-volt board and exciter board.
Inspect 2,300-volt bus and disconnect switches.
Inspect and clean exciters 1, 2, 3.

MONTHLY

C'ean and inspect lightning arresters.
Clean and inspect 11,000-volt oil switches—second and third Tuesday.
Clean and inspect 2,300-volt oil switches.
Clean and inspect compensators.
Inspect 11,000-12,300-volt transformers.
Inspect station auxiliary transformers and switchboard.
Clean oil and repair crane and equipment.
Blow out frequency changers.
Clean and repair solenoid-. perated field switches—first Tuesday.
Inspect Terrill regulator.
Test all 11,000-volt switches by tripping relays—second Saturday, January, April, etc.

BIMONTHLY

Clean and repair solenoid-operated field switches, February, April, etc.

SEMI-ANNUAL

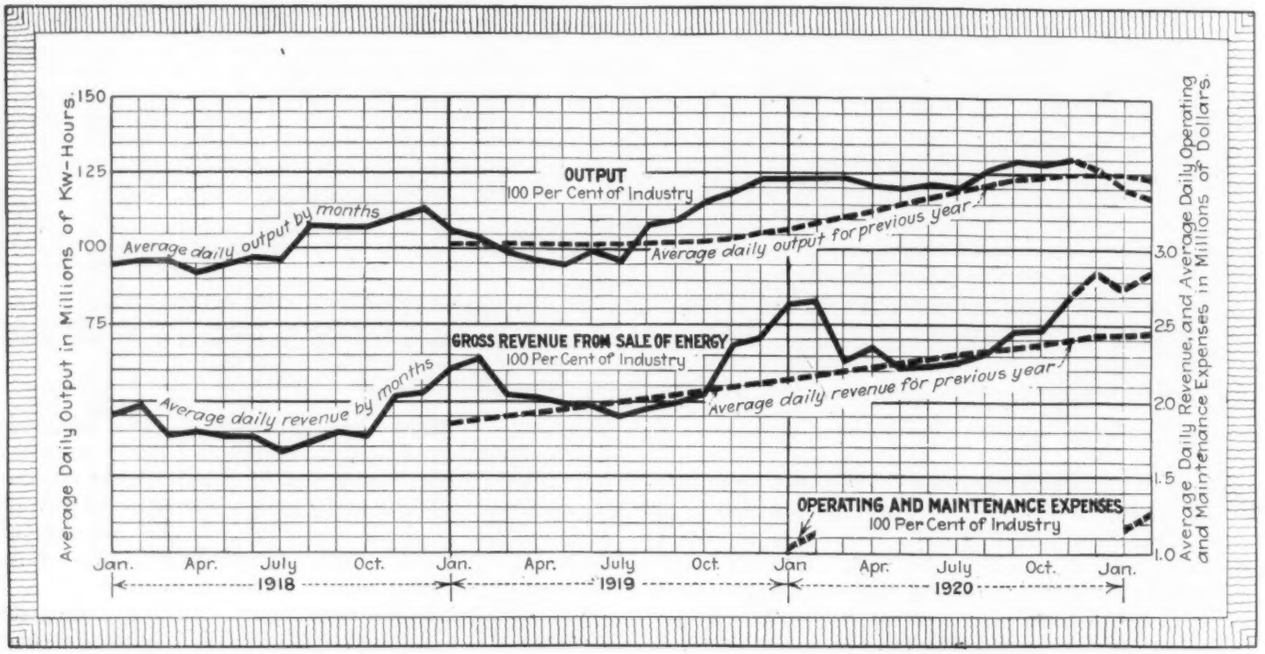
Change oil in frequency changers.
Inspect and change oil, if necessary, in frequency changers and oil switches.
Oil test transformer banks.
Oil test feeder regulators.
Oil test 11,000-volt compensators, 29th, 30th or 31st of January and July.
Oil test station light and power transformers, 29th, 30th or 31st of January and July.
Clean and wipe insulators, bus compartment current transformers, potential transformers, etc., 11,000-volt.
Clean 11,000-volt transformers.

Hydro-Electric Progress in Italy

THE United States Commercial Attaché at Rome reports that whereas in 1915 Italy's electric power resources amounted to 2,500,000,000 kw.-hr. per annum, they now approximate 4,000,000,000 kw.-hr. During the five years from 1915 to 1920 hydro-electric plants yielding 265,000 hp. were completed, and plants now under construction will yield 400,000 additional.

In these new undertakings it is estimated that approximately $400,000,000 (at old rates of exchange) will be invested.

Industrial Load Reaches Low Level



ELECTRIC LIGHT AND POWER COMPANIES REPORT DECREASED OUTPUT BUT INCREASED REVENUE DURING FEBRUARY

RETURNS received for the month of February by the ELECTRICAL WORLD from central generating companies representing 76 per cent of the installed rating of the country indicate that the industrial depression prevailing throughout the nation reached a low level during that month. Reports from some sections, however, point to considerable increase in power requirements by certain industries over those reported for January. The average daily output of the light and power plants in the aggregate was about 1,600,000 kw.-hr. below that of January, but this decrease is attributed in large part to the advancing season and consequent decrease in lighting requirements. Gross daily revenue received from sale of energy during February was about 5 per cent in excess of that reported for January, and only a fraction of 1 per cent below the record earnings reported in December. The average daily operating and maintenance expenses, however, were about 7 per cent above those reported for January, giving in general a resulting operating ratio during February slightly above that indicated by the January returns. A similar increase in the operating ratio was reported for the same period in 1920.

Increased activity in the boot and shoe manufacturing industry and definite improvement in textile-mill operations over those of January were prevalent throughout New England during February. Several other important industries, however, decreased their operations below those of January, with the result that the electrical energy sold to power customers in this section was probably about the same as during January. The average daily output of the central generating stations of New England decreased about 30,000 kw.-hr., due probably in large part to decreased lighting requirements.

During February the iron and steel mills reported the greatest curtailment in operations of all the primary industries. Judged by the decrease in number of men employed, operations in this industry showed a curtailment under January of about 7.3 per cent. However, the decreased energy requirements by the iron and steel industries of the Atlantic States were offset to a large extent by material increases in operations in the automobile, textile, leather and lumber industries of this section. In the South Atlantic States the textile indus-

TABLE I—CENTRAL-STATION RETURNS FOR TWELVE MONTHS

	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1920 Thousands	1919 Thousands	Per Cent Increase
Mar.	70	2,698,890	2,103,587	28.0	65	$46,155	$36,840	25.0
April	70	2,603,692	2,098,559	24.1	65	45,547	36,541	24.5
May	70	2,631,560	2,179,916	21.2	65	43,888	35,512	23.4
June	71	2,630,831	2,175,645	20.2	66	44,434	35,528	24.5
July	71	2,677,131	2,234 215	20.0	66	46,608	36,265	28.5
Aug.	71	2,769,175	2,303,099	20.1	66	47,410	36,713	29.1
Sept.	71	2,734,179	2,327,460	17.4	66	49,224	38,209	28.5
Oct.	71	2,797,625	2,499,488	11.9	66	51,370	41,055	25.1
Nov.	71	2,741,705	2,503,402	9.6	66	54,620	44,711	22.0
Dec.	71*	2,792,554	2,648,746	5.4	66*	57,697	48,580	18.6
		1921	1920			1921	1920	
Jan.	76†	2,803,241	2 967,611	-5.5	70†	59,486	51,276	15.9
Feb.	76‡	2,499,412	2,700,629	-7.4	70‡	56,450	48,755	15.7

	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting) 1921 Thousands of Dollars	1920 Thousands of Dollars	Per Cent Increase	OPERATING RATIO Steam Plants 1921	Steam Plants 1920	Hydro Plants 1921	Hydro Plants 1920	Combined Systems of Steam and Hydro 1921	Combined Systems of Steam and Hydro 1920
Jan.	40	14,620	13.150	11.2	56.3	55.5	26.8	27.0	38.7	46.5
Feb.	43	15,165	13,687	10.8	55.7	54.6	24.2	26.5	41.7	48.0

* Includes estimates for thirty-seven companies, representing 4.3 per cent of the total installed rating of all central stations.

† Includes estimates for thirty-four companies, representing 11 per cent of the total installed rating of all central stations.

‡ Includes estimates for seventy-four companies, representing 19.5 per cent of the total installed rating of all central stations.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A TWELVE-MONTH PERIOD

	Month	New England States				Atlantic States				North Central States				South Central States				Pacific and Mountain States			
		Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1920 Thousands	1919 Thousands	Per Cent Increase
KW.-HR. OUTPUT	Mar.	82	198,603	148,512	33.7	64	897,327	711,828	26.0	74	913,659	711,761	28.1	56	137,306	102,545	33.6	79	551,995	428,941	28.6
	April.	82	187,174	144,922	29.1	65	883,264	701,778	25.9	74	857,467	687,751	24.7	56	135,140	99,877	35.2	79	540,647	464,231	16.7
	May	82	188,566	148,186	27.5	65	854,631	711,276	20.0	74	862,127	700,095	23.5	56	137,779	98,815	39.2	79	588,457	521,544	12.6
	June	82	189,934	149,607	26.5	66	865,714	721,688	19.9	74	855,013	681,780	25.5	56	132,733	99,660	33.2	79	587,437	522,901	12.2
	July	82	190,668	159,000	20.0	66	881,241	714,485	23.5	74	841,351	702,302	19.7	56	138,937	106,460	30.1	79	614,934	551,959	13.4
	Aug.	82	194,028	171,002	13.5	66	905,170	728,097	24.2	74	891,712	750,787	18.6	56	147,082	111,573	32.0	79	631,183	541,640	16.5
	Sept.	82	194,730	170,593	14.1	66	905 872	758,737	19.5	74	878,237	758,017	15.9	56	147,524	113,649	30.0	79	607,816	526,464	15.5
	Oct.	82	196,310	191,132	2.7	66	964,739	841,694	14.5	74	896,241	817,757	9.5	56	157,267	126,769	24.1	79	583,068	522,136	11.7
	Nov.	82	193,231	183,624	5.4	66	953,436	825,011	15.5	74	895,229	861,352	10.5	56	144,889	125,438	15.0	79	554,920	507,977	9.2
	Dec.	82	210,494	227,403	−7.4	66	969,909	917,945	5.7	74	903,628	852,264	5.9	56	140,485	133,419	5.3	79	568,038	517,715	9.6
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	81	199,046	247,800	−19.7	77	1,005,566	1,043,650	−3.7	73	897,076	980,159	−8.5	62	144,936	145,336	−0.3	81	556,617	550,666	0.1
	Feb.	81	178,694	216,890	−17.6	77	886,578	948,043	−6.5	73	845,105	896,318	−5.7	63	132.290	132 544	−0.2	81	456 745	506,834	−9.9
REVENUE			1920	1919			1920	1919			1920	1919			1920	1919			1920	1919	
	Mar.	82	$5,136	$4,044	27.0	63	$17,696	$14,299	23.7	57	$13,270	$10,469	26.5	54	$2,910	$2,287	27.8	79	$7,148	$5,741	24.2
	April.	82	5,087	3,943	29.0	64	17,700	14,383	23.5	57	12,690	10,042	26.9	54	2,952	2,181	35.2	79	7,118	5,992	19.2
	May	82	4,897	3,741	30.1	64	16,624	13,631	21.9	57	12,471	9,853	26.8	54	2,829	2,140	32.0	79	7,067	6,147	15.1
	June	82	4,948	3,778	30.5	65	16,525	13,449	22.1	57	12,412	9,776	26.9	54	2,849	2,127	33.9	79	7,700	6,398	20.5
	July	82	5,009	3,802	28.5	65	16,899	13,438	25.5	57	12,822	9,793	30.9	54	2,747	2,194	35.0	79	9,131	6,948	31.5
	Aug.	82	5,075	4,093	24.0	65	17,210	13,731	25.9	57	13,497	10,151	32.9	54	3,168	2,281	38.1	79	8,460	6,457	31.1
	Sept.	82	5,409	4,296	25.9	65	18,081	14,456	24.5	57	13,834	10,522	31.5	54	3,262	2,386	36.5	79	8,638	6,549	32.0
	Oct.	82	5,675	4,623	22.7	65	19,201	15,722	22.0	57	14,458	11,667	23.9	54	3,504	2,551	37.3	79	8,532	6,492	31.5
	Nov.	82	5,898	5,017	17.5	65	20,938	17,119	22.2	57	15 158	12,561	20.8	54	3,853	2,910	32.4	79	8,775	7,104	23.5
	Dec.	82	6,548	5,744	14.0	65	22,332	19,149	16.7	57	16.004	13,142	21.8	54	3,722	3,113	19.8	79	9,091	7,432	22.3
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	81	6,457	6,243	3.7	74	22,213	19,226	16.2	59	17.345	14.777	17.5	62	4,155	3,484	19.3	81	9,316	7,546	23.4
	Feb.	81	5,924	5,728	3.5	74	21,169	18,023	17.2	59	16,842	14,436	16.8	62	3,971	3,328	19.3	81	8,544	7,240	17.8
OPERATING EXPENSES:																					
			1921	1920			1921	1920			1921	1920			1921	1920			1921	1920	
	Jan.	34	$1,098	$1,288	−14.7	48	$6,400	$5,437	17.8	28	$3.972	$3,488	13.8	37	$1,027	$916	12.1	54	$2,135	$2,030	5 2
	Feb.	35	1,070	1,240	−13.7	53	6,825	5,929	15.0	29	3,997	3,484	14.6	44	1,232	1,065	15.7	55	2,041	1,969	3.6

try consumes about 41 per cent of the energy sold by light and power companies, and this industry reported about 250,000 more spindles active during February than during January. Moreover, the lumber mills of the South, which purchase more than 5 per cent of the electrical energy sold to power customers in that section, reported that operations in that industry had increased from 51.5 per cent below normal in January to only 35.5 per cent below normal in February. As a result of these conditions, together with a falling off in the lighting load, the daily output of the light and power companies of the Atlantic States was only about 2 per cent below that of January.

In the North Central States two opposite conditions were presented by two of the chief consumers of electrical energy in that section, the iron and steel industry and the automobile and allied industries. The iron and steel mills of this section were operating at near 10 per cent below January, while the automobile industry as a whole increased operations by almost 20 per cent over those of January. The prevailing trend in this section during February was toward increased activity except in a few industries. These increased activities were reflected in an increased daily output for the central generating stations of more than 1,700,000 kw.-hr.

The Mountain and Pacific States reported a larger decrease in central-station output for January than any other section, about 9 per cent. A slowing down in industrial activities was reported from all parts of this section, which was to be expected as a reflection of the depression existing in the East. The largest decreases in electrical energy requirements, however, were reported by the Mountain States and were due to a low ebb in both mining activities and operations by urban industries.

TABLE III—AGGREGATE OPERATING RATIO OF COMPANIES REPORTING DATA MONTHLY TO THE "ELECTRICAL WORLD"

Type of Generating Plant and Month	New England States				Atlantic States				North Central States				South Central States				Mountain and Pacific States			
			Average for Year				Average for Year				Average for Year				Average for Year				Average for Year	
	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920	1921	1920
Steam Plants:																				
January	54.0	60.8	54.0	60.8	53.5	50.9	53.5	50.9	61.5	62.1	61.5	62.1	54.0	54.7	54.0	54.7	69.0	60.5	69.0	60.5
February	54.3	59.5	54.2	60.3	52.3	53.6	52.8	52.1	63.1	58.1	62.3	60.2	59.8	50.0	57.0	50.8	60.2	60.3	64.3	60.3
Hydro Plants:																				
January	26.5	35.2	26.5	35.2	21.2	21.2	21.2	21.2	25.0	20.8	25.0	20.8	26.4	20.1	26.4	20.1	28.4	27.9	28.4	27.9
February	30.1	46.5	26.8	35.6	20.1	20.6	20.7	20.9	26.1	29.3	25.6	25.1	28.6	21.4	27.4	20.5	25.7	28.5	27.2	28.2
Combined Systems of Steam and Hydro Plants:																				
January	45.3	53.5	45.3	53.5	45.3	48.1	45.3	48.1	42.8	44.8	42.8	44.8	38.6	46.6	38.6	46.6	35.0	45.5	35.0	45.5
February	44.3	60.0	44.7	58.8	43.4	43.8	44.4	45.9	43.2	50.9	43.1	50.0	41.7	38.6	40.5	42.0	39.2	44.0	37.0	44.7

Readers' Views and Comments

This is a readers' forum. Comments on questions before the electrical industry presenting economic, financial, engineering or commercial aspects and new or supplementary viewpoints on published articles are cordially invited

Electrical Importance of the Southwestern States

To the Editor of the ELECTRICAL WORLD:

SIR: In studying the summary of the "Electrical Importance of the Various States" in the March 19 issue of the ELECTRICAL WORLD the writer was forcibly impressed with the peculiar position occupied by the States of Arizona and New Mexico. These two states, which actually have a very high ratio of kilowatt-hours per capita, are shown as almost a negligible factor. In the majority of the states the output of the central stations is vastly greater than the combined output of the isolated plants and the isolated plants have a comparatively small installed capacity when compared with the central stations. In the Southwestern States, however, the reverse is true. The largest and most modern plants are installed by companies which use the bulk of the power generated in their own processes and usually carry the utility load of the community as a convenience for their employees.

On the basis of the 1919 output, which marked a period of severe restriction in the production of copper, there were a number of companies in these states that produced far more power in the course of the year than the total reported sold for power purposes. In fact, several of these plants generated more than the combined power sold in the state for both light and power. These plants are not large in comparison with many of the central stations in other sections, comparatively few of them being of sufficient capacity to justify the use of units larger than 10,000 kw. capacity, although a good many require units of 5,000 kw. to 7,000 kw. The load factor is very high. In normal times a variation of 20 per cent in twenty-four hours is unusual, and this variation is frequently caused by hoisting loads with regular cycles and can be provided for. With a steady load and small peaks, the plant investment is small in comparison with the total annual output, and power costs are on a comparative basis with many larger plants operating on a lower load factor. From this point of view the relative electrical importance of these states cannot be measured by the output of the central stations alone. This is, of course, true in any state, but not nearly to such an extreme.

Regarding future possibilities, the central and northern portions of these states have considerable potential hydro-electric development, but these water-power sources are mainly in very inaccessible locations and will be costly in development. A large portion of the power now being used is generated from the waste heat of the smelters, and this will hardly be supplanted by purchased power. The mines are in very rough country and are widely separated. Very little additional load can be expected along the lines, except possibly extensive railway electrification. The long distances and density of traffic will hardly warrant the expenditure under present conditions.

In all probability the development of these water powers will be slow, and the electrical importance of these states will for a long time lie not in the central stations but in the large mining companies.

El Paso, Tex. T. H. ARNOLD.

[In preparing tabulations and maps no effort was made to include the energy generated by private plants. At the present time such data are not available for the entire country, but they are being rapidly accumulated by the ELECTRICAL WORLD and will be published as the survey of various sections is completed. The operations of the central generating stations, however, are believed to be a very dependable barometer of the status of electrical development in the various states.—EDITOR.]

Cost Estimate for 60,000-Volt Line

To the Editor of the ELECTRICAL WORLD:

SIR: On page 431 of the Feb. 19, 1921, issue of the ELECTRICAL WORLD the estimated cost of a 66,000-volt branch line is given in detail. It is noted that nothing is included in the estimate to cover the cost of surveying, engineering and overhead. In a country where clearing costs about $700 per mile I should expect that it would cost about $75 to $200 per mile to make the survey. In general, overhead expenses, including engineering and surveying, run from 10 to 20 per cent of the cost of material and labor. Since the estimate given does not include this item it seems to me that it does not reflect the true cost of the line.

PAUL P. ASHWORTH,
Distribution Engineer.

Utah Power & Light Company,
Salt Lake City, Utah.

Hydro-Electric Construction in Italy

To the Editor of the ELECTRICAL WORLD:

SIR: Every now and then American readers of technical publications hear about wonderful hydro-electric projects which should accomplish even more wonderful results. Frank W. Chase's letter in the ELECTRICAL WORLD for Jan. 8, 1921, shows the natural reaction of an engineer's mind against all the nonsensical exaggeration of the power schemes which are one of the blessings of the aftermath of the great war.

Projects foolish both in their engineering conception and in the calculation of their financial possibilities have been springing up like mushrooms all over Europe, and Italy has shared this experience with all her neighbors. It is said that engineers of important American public utility corporations have come hither on a wild-goose chase after wonderful sites which had the only drawback of being already leased under franchise to other companies, and it is certain that any person who has suffered such disappointments is likely to drop European power schemes like a hot potato. But, nevertheless, there are a number of very important hydro-electric projects under construction in Italy, and a few are of such magnitude as to rank among the leading ones in the whole world.

The Adriatic Electric Power Company and its associated companies are building what may be considered one of the most important installations on the Continent. By deflecting the Piave River into the Santa Croce Lake near Belluno, by damming the Alpago Valley and build-

ing tunnels and pipe lines, this company will be able to operate six power plants with a total of 300,000 hp., the average yearly output of power being calculated at about 650,000,000 kw.-hr. Two of the power plants, the Fadalto No. 1 and the Nove No. 1 installations, are already supplying more than 100,000,000 kw.-hr. at 55,000 volts and 42 cycles. By the end of this year the Fadalto power house No. 2 and the San Floriano plant will probably be completed, adding a yearly average output of 120,000,000 kw.-hr. The transmission voltages will be 55,000 volts and 110,000 volts, 42 cycles.

By 1924 the tunnel from Lago Morto to Nove will be completed, and the Nove No. 2 plant will be started, adding 90,000,000 kw.-hr. yearly, with transmission voltages as above. By 1926 the Livenza canal and power plant will be put in operation, adding a yearly average output of 150,000,000 kw.-hr. By 1928 the project will be definitely completed by the addition of new pipe lines and tunnels and of six 20,000-hp. and two 1,300-hp. generating units in the existing plants. This will add a medium yearly energy output of 225,000,000 kw.-hr.

It must be understood that a rather important amount of tunnel work is responsible for the length of the construction period, together with the fact that all this work has to take place in a region which was most severely dealt with by the Austrians during the war, and where, therefore, electrical construction work must go hand in hand with general reconstruction work of a very difficult nature.

The members of a committee of American bankers and business men, delegates to the International Chamber of Commerce convention, were truly astonished when they were shown through the different plants and works of the Santa Croce undertaking in July, 1920, to find that every nook and corner was alive with hustling construction work where only eighteen months before one of the greatest battles of the war, that of Vittorio Veneto, had been fought and won.

Other Italian companies are pushing toward completion a number of very important hydro-electric projects, the most important of which, after those of the Adriatic group, is no doubt that of the Italian Edison General Electric Company. This company and its associated undertakings have in construction a number of plants totaling over 350,000 hp. Then there is the Ovesca development, which makes use of the water of the Introna Lake and of the artificial reservoirs of Alpe Cavalli and Alpe Campiccioli to operate the Rovesca power house (48,000 hp., 130,000-volt, 42-cycle transmission), and, further down, the Pallanzeno power house of the same capacity. The Mese and Truzzo power plants of the Cisalpine Hydro-Electric Power Company (an Edison subsidiary) will total 200,000 hp., with a medium annual output of 280,000,000 kw.-hr. The Adamello Electric Company has under construction the Ozola development, which will total 60,000 hp., with a medium yearly production of 115,000,000 kw.-hr., and the Salarno and Avio developments, totaling about 55,000 hp., with a yearly medium output of 140,000,000 kw.-hr.

These are by no means the only hydro-electric plants under construction in Italy. Installations of between 15,000 hp. and 20,000 hp., of which there are more than a score nearing completion, and other plants under construction of lesser power have not been considered.

LYMAN GEORGE STUCKE,
Secretary.

Compagnia Italo-Americana di Elettricita,
Rome, Italy.

Sane Safety Versus Insane Safety

To the Editor of the ELECTRICAL WORLD:

SIR: The man who plays absolutely safe seldom gets very far ahead in the world. Usually he falls behind and is a failure compared to the normal business man who takes normal business risks. The man who occasionally runs a risk may lose occasionally, but on the whole he gains more than the man who tries for 100 per cent safety.

The campaigns for increased safety are most of them sane, and most of them have accomplished fine results. The following examples are not put forward, therefore, in order to decry the safety movement, but are merely to point out that service and sanity are the really important things and that we should strive for safety only when on the whole increased safety means increased service and comfort.

A good example in electric work is the question of a safe voltage, say for trolley wires. A voltage of 500 may kill if a wire drops into the street. So may 220 volts and so may 100 volts if the conditions are just right. There is a case on record, or at least current in medical circles, where 2 volts killed a patient with a weak heart. The 2 volts was on an exploring lamp in the throat near the nerve centers and the moist mucous membrane made a good contact. It was a most unusual accident, but it shows that even 2 volts is not a 100 per cent safe voltage, and it is clear that 500-volt trolley wires are not 100 per cent safe. Yet, is not 500 volts a proper trolley voltage in cities in spite of not being 100 per cent safe? Again, what is a safe speed for an automobile? Is there not some danger in anything over 4 miles an hour, the speed provided by the old English code or law for automobiles? Yet who wants an automobile speed that is 100 per cent safe?

One hundred per cent safety is an absurdity. What is wanted is sane safety, which may be sometimes 99.9 per cent, sometimes 99 and sometimes 90 per cent. It is always a question not of safety alone but of balancing advantages. The first safety precautions and some safety campaigns pay well, but they easily get beyond the point of sanity.

The expressed desire for 100 per cent safety, based on the plea that human life is worth any number of dollars, may be merely the lazy-minded excuse of the man who wants to put something over. Sometimes his scheme is good in itself. For instance, the block signal system on railways is probably worth while, the steel railroad car is probably worth while, and so on. On the other hand, the guard wires above the trolley wire are not worth while. It is not worth while to force transatlantic vessels to travel in pairs or with convoys in time of peace.

We want sane safety, not insane safety. We don't want to spend more for any particular kind of safety device than that device is worth. Even if it will save human life, yet its cost may be such that the same money spent in some other way, as on some other safety device, may save still more human lives or add more to human happiness.

For any safety device or scheme it should be shown, first, what it will cost and, second, what it will accomplish. If it will accomplish more than the same money and same effort when applied in some other way, the cause is good and it is unnecessary to talk 100 per cent safety and the sanctity of life. KASSANDRA.

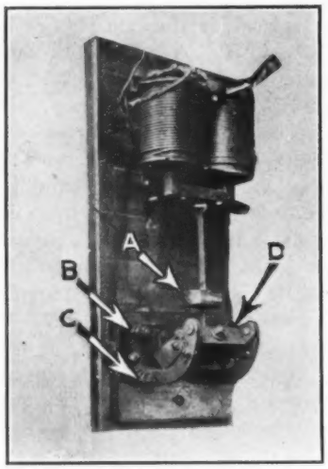
Boston, Mass.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Effective Street-Light Switch

AN INEXPENSIVE switch to use where 110-volt lamps for decorative lighting in parks and on bridges are to be turned on at the same time as the street arc lights is shown in the accompanying illustration. The solenoid coils with their yoke were taken from an old arc lamp, and the switch is part of an excess-demand indicator. These were mounted on slate and connected by a rod having a weight *A* on it to pull the switch open. With this type of switch there is the smallest amount of pitting and friction since it was designed for just such use. The coils are connected in series with the arc circuit, the 110-volt circuit being connected to binding posts *B* and *C* and the two on the other side not shown. Normally weight *A* holds the switch open by gravity, but when current flows through the coils the yoke pulls up the rod and switch arm, holding the switch closed as long as current flows in the arc circuit.



SWITCH FOR TURNING ON LIGHTING CIRCUIT

Laminated cores may be put in the top of the coils but should not extend down far enough for the yoke to hit them, and the laminations should be tight as vibration might be objectionable. The two circuits can have no electrical connection even if the coils become grounded as bar *D* is of fiber. The switch was devised by T. F. Breithaupt of the Connecticut Light & Power Company.

D. A. McNULTY.

Waterbury, Conn.

Curve-Drawing Thermometers to Study Insulator Failures

IN ORDER to determine the relation between temperature and failure of suspension insulators on the 150,000-volt Big Creek lines of the Southern California Edison Company, four curve-drawing thermometers have been installed at points along the line. These thermometers are provided with weekly charts and have a temperature scale from 0 deg. to 120 deg. F. Two of the instruments have been placed at the points where the maximum number of insulator failures have occurred, and two have been placed at those points where the minimum number of insulator failures have occurred.

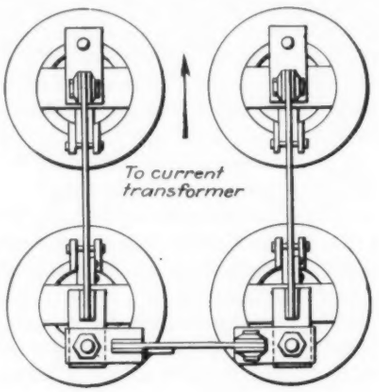
Along portions of this line as much as 60 deg. F. daily variation has been found in the temperature, and from a careful analysis of these results it is hoped to determine what relation if any exists between temperature and insulator failures.

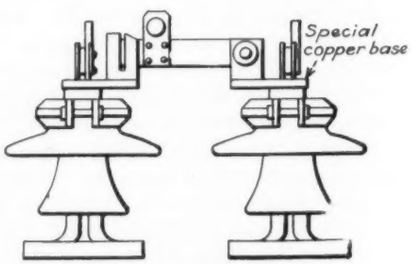
S. R. VAN DREZER,
Chief Patrolman.

Southern California Edison Company,
Kern, Cal.

Convenient Disconnecting Switch for Current Transformers

A COMBINATION of two disconnecting switches with a short horizontal blade across the upper terminals to short-circuit them makes a convenient arrangement for use with current transformers. The arrangement is shown in the illustration and may be made up with any manufacturer's standard disconnecting switch. The smaller short-circuiting blade will require special castings to fit the standard disconnecting terminals. Current transformers connected through such an arrangement can be readily cut out of circuit for repairs, and meter testers can test current transformers and meters together as a unit without the necessity of waiting for night or Sunday hours when load conditions will permit interruptions to service to take equipment out of circuit. The arrangement can be easily applied on circuits of any voltage and the switches made up for indoor or outdoor use. The switch is used by a large Middle Western company as standard equipment on customers' substations up to 27,000 volts. No means has been developed of interlocking the short-circuiting and main disconnecting switches to prevent opening the circuit until the short-circuiting switch has been closed, though a simple mechanical interlock would seem easily possible.





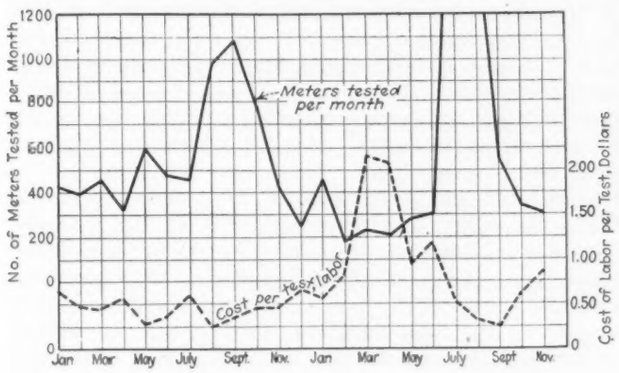
CURRENT TRANSFORMER CONNECTED ABOVE MAY BE SHUNTED OUT WHEN DESIRED

Chicago, Ill.

FIELD EDITOR ELECTRICAL WORLD.

Graphic Form of Records for Showing Cost of Testing Meters

IN ORDER to show at a glance the cost of meter tests a graphic form of record is kept by the Worcester (Mass.) Electric Light Company. This record shows the number of meters tested monthly and the cost of testing per meter. It may be noticed from the curves that as more meters are tested the cost of testing each meter is lower. These curves are plotted from the monthly records of the number of meters tested. George



COST OF METER TESTS AND NUMBER TESTED EASILY SEEN FROM THESE CURVES

M. Hardy, superintendent of the company, is responsible for the development of these charts.

Similar records used for various purposes have been described in previous issues of the ELECTRICAL WORLD and more will be published later.

FIELD EDITOR ELECTRICAL WORLD.

Boston, Mass.

Economical Use of Flashboard Supports on a Curved Dam

A SAVING is effected at the stations of this company at Turners Falls by making the pipes which support flashboards 11 ft. long, thus making it possible to use them three times. When the spring high water of the Connecticut River falls sufficiently to enable the total flow of the river to be taken through the wheels and floodgates, flashboards are installed on the curved dam at this development. These boards are supported by 3.5-in. iron pipes. The pipes are purchased in 22-ft. lengths and are cut in half. On them are bolted 2-in. x 4-in. hemlock nailing strips, to which the flashboards are nailed. The pipes are set in sockets in the dam 2 ft. deep and 7 ft. of flashboards are maintained. If the pipes are bent over once, the 2-ft. portion in the socket is cut off and the remaining 9 ft. are used over again.

If the pipes are bent a second time, they are 2 ft. shorter than is required, and in the top of the pipe a wooden plug is inserted, the latter being made by turning down a 4-in. x 4-in. hardwood stick. Even with a recent pipe cost of 85 cents per foot, the cost per year is not heavy on account of this triple use, and in most years it is possible to remove the pipe with virtually no loss.

In erecting the flashboards the pipes are first inserted in the sockets. A ranger, consisting of 4-in. x 4-in. hardwood timber, runs the entire length of the dam and about 5 ft. above the crest. This is attached to the pipes by U-bolts. Braces are placed under the ranger and against the pipe, being set against solid iron pins on the crest of the dam. These pipes with 7 ft. of board are figured to fail without any bracing when the water is 6 in. over the top of the boards, and experience shows that they fail at about this height.

As the water begins to rise in the fall the braces are not removed because there is no ice and there is insufficient rubbish in the river to cause damage. The boards are stripped off and the water is allowed to flow between the pins. No braces or rangers are removed. After high water passes the boards are replaced and are usually not touched during the winter. In spring, when the river breaks up, the heavy ice in the pond above the dam makes it necessary to strip off all the rangers, braces and pins. When the rise of water starts the braces are removed to make sure that the water will not back up too far. The boards are removed to the crest and the pins and rangers taken off to give a clear crest when the water reaches a height that requires the removal of all flashboard equipment.

C. I. HOSMER,
Hydraulic Engineer.
Turners Falls Power & Electric Light Company,
Turners Falls, Mass.

Gate-Opening Indicator Used for Indicating Kilowatts

A GATE-OPENING indicator is employed to measure the kilowatt output of an isolated hydro-electric plant in which there was no indicating wattmeter installed to measure the power. Because a new plant is to be built in the near future it was not desired to purchase any equipment for the present one as it will be dismantled. However it was necessary to measure the kilowatt output, approximately, and the method mentioned was found nearly enough satisfactory.

A portable wattmeter was obtained and its performance recorded on a paper disk pasted on the gate-opening indicator of a 2,500-ft.-lb. special Lombard governor. Lost motion in the connections and between the governor and gate was found to be negligible, as also was the small clearance in the meshing of the pinion and "rack" by which the pointer on the indicator is driven. The

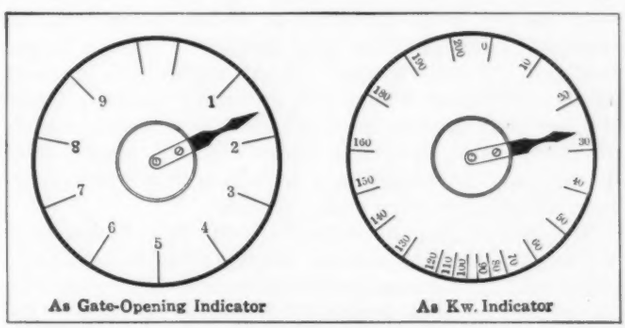


CHART CALIBRATED IN KILOWATTS WAS PASTED ON DIAL OF GATE-OPENING INDICATOR

portable indicating wattmeter was retained for two days following the recording of the chart, during which an average of the various load changes occurred. This little governor, kept in first-class condition, is very sensitive and steady in its actions. The two days' checking showed no appreciable change. R. W. LOYD,
Electrical Engineer.
Florence Silver Refining Company,
Ainsworth, B. C., Canada.

Size and Type of Condenser Required for Small Plants

IN NEARLY all power plants surface condensers should always be used unless the cooling water is particularly good for boiler feed, which is not often the case. By the use of surface condensers condensed steam becomes available for boiler feed, which, unless the condenser leaks, is pure distilled water and will not scale up the boiler tubes. Consequently boilers may be run for longer periods between cleanings and fewer tube failures will result. But surface condensers are more expensive and jet condensers are often put in to reduce the initial investment. With this condenser the cooling water mixes with the condensed steam, and usually all is thrown away unless the condensing water is very good.

With surface condensers the amount of surface is usually based on a condensation of about 7 lb. of steam per square foot of surface per hour, or about 1.6 sq.ft. of surface per kilowatt of rating. For instance, for a 12,500-kw. generator this amounts to 20,000 sq.ft. A modern turbine of this size designed for 200 lb. pressure and 200 deg. Fahr. superheat will generate a kilowatt-hour on about 11.25 lb. of steam, or 140,600 lb. of steam per hour, which amounts to approximately 7 lb. per square foot of condenser surface. To condense 1 lb. of steam in the condenser requires the extraction of about 950 B.t.u. per pound of steam. If the rise in temperature of the cooling water passing through the condenser is 15 deg. Fahr., the quantity of water required will be about 18,000 gal. per minute. If clean enough, this water can be pumped into the service water lines; if not, it can be thrown away. With this quantity of condensing water a vacuum of 29 in., or 1 in. absolute, will be obtained with inlet water at 50 deg. Fahr. and the condenser reasonably clean. Better results are possible with the condenser in good condition.

The condensing water will be pumped by a centrifugal pump, and if the discharge pipe from the condenser is carried below the water level, the head against the pump will be about 15 ft. or 16 ft. As the pumps in ordinary commercial service will not average much over 50 per cent efficiency, a 75-hp. motor will be required, although it is good practice to use a larger size, say 100 hp., especially if the motor is in a warm place. Low-speed pumps are, generally speaking, more efficient than high-speed ones for this service. Speeds of 200 to 300 r.p.m. are about right if steam drive is required. This calls for a reduction gear which, however, should give very little trouble.

To remove the condensate from the condenser a centrifugal pump is now universally employed, and provided that it is correctly vented back to the condenser, no trouble is to be expected from it. To remove the air it is now customary to use a type of hydraulic vacuum pump which operates by trapping air between sheets of water and so carrying it out to atmosphere against the vacuum. This pump gives a good vacuum if the air leakage is normal, say 5 cu.ft. to 10 cu.ft. of free air per minute. The only draw-back is that it takes a lot of power. On a large unit the percentage of the total is not large, say 100 hp. for a 30,000-kw. machine; but for a 5,000-kw. unit the ratio grows larger. The old Edwards air pump takes little power and has the advantage that less power is required as the vacuum is increased.

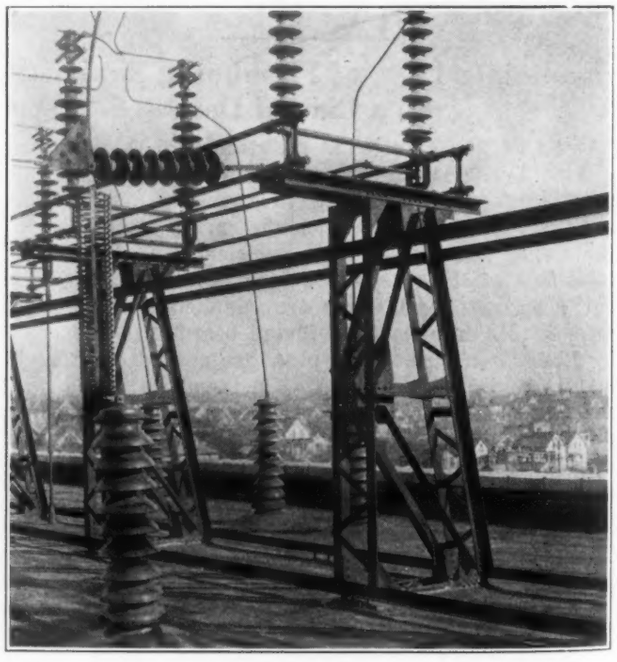
Steam-jet pumps are now being put on the market and have the advantage of small size, and so long as the steam can be returned to the feed water no heat is lost. Provided that a simple arrangement can be worked out, the steam jet is quite economical.

Sargent & Lundy, Chicago, Ill. A. B. CLARK, Engineer.

Space Saved and Troubles Reduced by Design of Choke Coil

CHOKE coils for four incoming 100,000-volt lines originally occupied a space 15 ft. wide and the full length of a St. Louis substation roof, but by a change in design and arrangement that space has been cleared of equipment. Each coil was originally mounted horizontally on three post insulators, each of which was equipped with seven 10-in. disks. These post insulators gave a considerable amount of trouble from deterioration of individual disks, and their proximity to the roof presented a considerable life hazard. Both of these objections were overcome by the choke coil designed and manufactured by the power company's engineers and shown in the accompanying illustration. Instead of going through the choke coils as the line crosses the roof of the substation, as was the case in the original design, the line is now carried directly across the roof and then down through a vertically mounted choke coil which acts as a connection between the overhead lines and the roof bushing.

The coil is made of extra-hard bronze, and the turns are kept in position by reinforcing strips of hard wood. This construction is used at the 100,000-volt Page



VERTICAL CHOKE COIL MORE SATISFACTORY IN THIS LOCATION THAN STANDARD HORIZONTAL DESIGN

Avenue substation of the Union Electric Light & Power Company, St. Louis, and by the changes which have been described it has been possible to eliminate three post insulators on each phase of the four lines.

Union Electric Light & Power Co. St. Louis, Mo. C. C. ROBINSON, Superintendent of Electric Stations.

Industrial Applications

The Economical Utilization of Electrical Energy
in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Standardized Pumping-Plant Substation for Arizona Valley

SUBSTANTIAL yet simple and inexpensive construction of transformer stations for pumping plants on the 200,000 acres of the Salt River Valley Water Users' Association, surrounding Phoenix, Ariz., has been achieved as shown in the illustration. The pole on the right acts as a dead-end pole. It is guyed to the pole on the left, which in turn is guyed to a dead-man. The line crosses to the pole-top lightning arrester placed at the top of the pole to the left. From this it is connected to the outdoor-type oil switch, which is suspended from buck-arms. From the switch the lines connect with a bus strung between the two poles. Thence they connect with the transformers placed on a platform between the poles. Between the bus and the transformers the connecting wires are steadied by an intermediate support. Within the pump house the meters and motor switch are placed on a panel. The whole makes a very substantial form of construction. Several score of such plants are now in operation. FIELD EDITOR ELECTRICAL WORLD.

TRANSFORMER STATION AT PUMPING HOUSE WHICH IS BOTH SAFE AND INEXPENSIVE

San Francisco, Cal.

Furnace Logs and Records Aid in Operation

IN ORDER to know more closely the cost of the particular grade of metal being manufactured in an electric furnace, and also to attain more nearly maximum efficiency, many operators keep an accurate log of every step of the process. This log shows at a glance the charge, weights and constituents, the amount of the various alloys and slag material used and their time of addition, the production of each melt, the amount of scrap, a careful record of the actual furnace operation, a record of delays, electrode record and analysis covering the metal and slag. Such a log is kept of each individual heat, and a summary of logs is made at the end of every month.

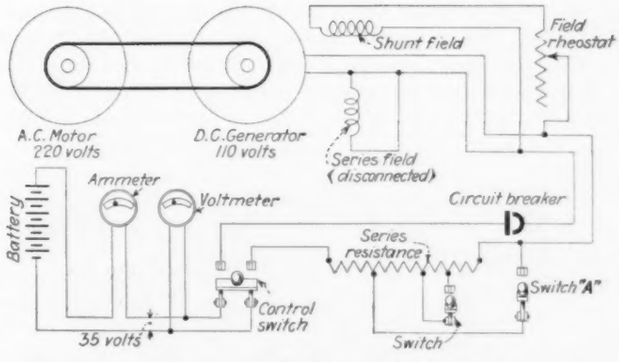
This summary shows among other items the number of kilowatt-hours per pound of electrode. It is obvious that the manufacturers of various grades and kinds of steel require different input in kilowatt-hours per ton, and it can easily be seen that because of this the best basis of comparing electrode service is the figure showing the number of kilowatt-hours per ton of electrode and not the number of pounds of electrode per ton of product.

Frank J. Vorbergh of the National Carbon Company, Inc., furnished this information.

Simple Improvement in Truck-Battery Charging Saves $36 a Year

A SAVING of $36 per year in the cost of charging a storage-battery industrial truck resulted from a recent study of conditions in an industrial plant by Reeds & Thorpe, consulting engineers, Hartford, Conn. The charging was done originally by a 115-volt generator, cutting the potential down to 35 volts with a charging rheostat. A 51 per cent reduction in energy consumption was effected by decreasing the generator voltage to 50 by the field rheostat and using only part of the charging resistance.

The truck was equipped with Edison batteries and was charged after working hours by a direct-current, 115-volt compound-wound generator driven by a 10-hp. alternating-current motor supplied by purchased power. The charging current was 35 amp. at 35 volts. The generator potential of 110 volts was reduced to 35 volts by a resistance grid with various taps connected to switches for cutting out parts of the resistance. These switches, however, were never used, all of the resistance being left in service, and the charging current was regulated by the generator field rheostat. The accompanying diagram makes the connections clear. The 115-volt generator was used because it met other uses in emergency as an exciter, etc. As a result of this method of operation the generator output was: 110 volts × 35 amp. = 3.85 kw. The power utilized by battery was 35 volts × 35 amp. = 1.25 kw.; thus



POWER REQUIRED FOR CHARGING BATTERY WAS DECREASED BY LOWERING GENERATOR VOLTAGE AND SHUNTING MOST OF RHEOSTAT

only 1.25 kw. ÷ 3.85 kw. = 32.5 per cent of the generator output was utilized.

By closing switch *A* most of the series resistance was cut out of service, and the generator potential was reduced to 50 volts by the field rheostat. The generator output was then 50 volts × 35 amp. = 1.75 kw., so that 1.25 kw. ÷ 1.75 kw. = 71.5 per cent was utilized. The annual saving, on the basis of three hours per day charging, $0.015 per kw.-hr. for power, and efficiencies of conversion through the motor and generator of 76 per cent before and 73 per cent after the change, are as follows:

Motor input before change =
3.85 kw. ÷ 0.76 = 5.06 kw.
Motor input after change =
1.75 kw. ÷ 0.73 = 2.40 kw.
Saving due to change = 2.66 kw.
2.66 kw. × 3 hours × 6 days × 50 weeks = 2,400 kw.-hr., 2,400 kw.-hr. × $0.015 = $36 per year.

The operation of the compound-wound generator, while not so stable as at 110 volts, was satisfactory. One night, however, the power supply failed, and the batteries started to discharge and drive the generator as a motor. Before either the circuit breaker or the no-voltage release on the motor compensator opened, as they should have done, the reversal of current had changed the polarity of the generator. To eliminate the possibility of a recurrence of this trouble the series field was disconnected. The operation since then has been more stable and entirely satisfactory.

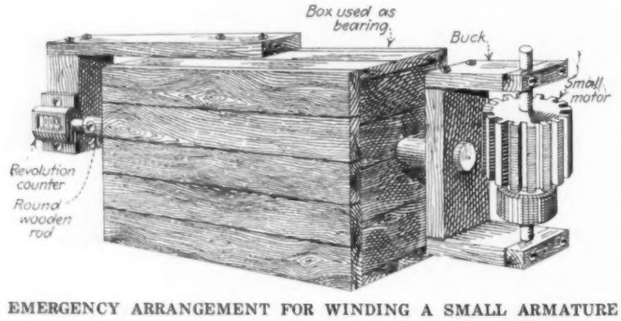
Reeds & Thorpe, Hartford, Conn.

CLARENCE AUTY, Electrical Engineer.

Arrangement for Quickly Winding a Small Armature

TO MAKE a rapid and accurate rewinding of the small armature of an appliance motor use was made of the hastily constructed machine shown in the sketch. The armature was mounted in a small buck of the same model as the larger ones in use in the shop. A broom handle was then fitted to a hole bored in the center of the buck base. In each end of a suitable box a hole was bored just big enough to take the broom handle with a snug fit. A revolution counter, direct-connected, was attached to the back end of the broom handle and the apparatus was complete.

The armature was revolved with the right hand, while the left hand guided the wire into the slots. The



EMERGENCY ARRANGEMENT FOR WINDING A SMALL ARMATURE

revolution counter recorded the number of turns and allowed all attention to be concentrated on the proper placing of the wire in the slots. The job in question was turned out in about two-thirds of the time required by the customary hand method.

FRANK SOETE.
Honesdale, Pa.

High Intensity Improves Sewing-Machine Lighting

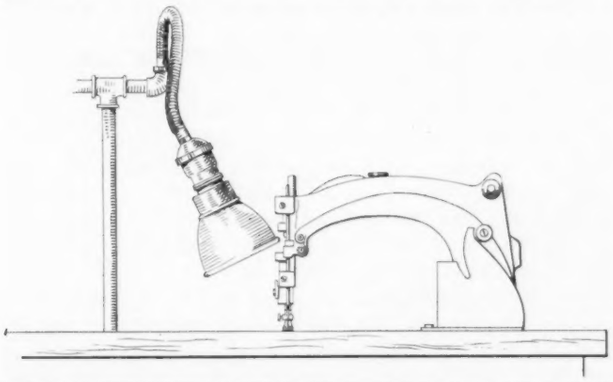
IN RECENT industrial lighting installations the very decided trend has been toward general overhead systems. However, cases are sometimes encountered where certain operations require a much higher level of illumination than is required for the work as a whole, and in such cases a general lighting system which will provide sufficient light for these special operations is likely to be uneconomical. This is usually true with regard to sewing-machine lighting, although general lighting has been used very satisfactorily where the sewing was done on light-colored goods, or even on dark goods if close accuracy was not required. For close work in sewing on dark goods it is necessary to have in the neighborhood of 40 foot-candles at the needle point to enable the operator to work at the best advantage. However, with a system of local lighting

SEWING-MACHINE ROOM, SHOWING EFFECT OF 9 FOOT-CANDLE GENERAL ILLUMINATION AUGMENTED BY LOCAL LIGHTING AT NEEDLES

giving this illumination at the work a certain amount of general illumination is very desirable in order to relieve contrasts, improve appearance and make for the safety and comfort of the workers. The usual practice has been to provide from 1 to 4 foot-candles of general illumination in addition to the local lighting.

A Cleveland company which manufactures women's cloaks and suits has recently installed a modern system of local lighting in its sewing-machine room. The old system in this room consisted of a number of 100-watt clear gas-filled lamps in reflectors hung more or less promiscuously about the room. Over each sewing machine was a drop cord with a 40-watt or 60-watt clear vacuum lamp equipped with a battered tin shade of little or no reflecting value. The effect of the whole installation was to give the room a very untidy and crowded appearance, due chiefly to the large number of drop cords. The new general overhead-lighting system consists of 150-watt bowl-enameled, gas-filled lamps fitted with "RLM standard dome" type enameled-steel reflectors on approximately 10-ft. x 10-ft. (3-m. x 3-m.) centers, mounted 10 ft. above the floor. Local lighting is supplied to each machine by a 15-watt clear vacuum lamp fitted with a deep-bowl reflector mounted on an adjustable arm. With this installation fully 40 foot-candles is obtained at the needles, with an average of

9 foot-candles general illumination throughout the room. Although 9 foot-candles is a higher level of general illumination than is found with older local lighting systems, it was considered desirable in this instance on account of the accurate work required on the dark goods and to facilitate the handling and arranging of



SPECULAR REFLECTION MUST BE PREVENTED TO SAVE EYE STRAIN AND MAKE COMFORTABLE WORKING CONDITIONS

goods at the machines. This higher general illumination also relieves the contrast between the brightness of the work and the rest of the room and has proved more restful to the operators' eyes than the previous installation, when the room was in comparative darkness.

This installation has been in use for several months, and the managers are satisfied that much better work is being done because of the higher level of illumination on the work and the improved appearance of the room as a whole.

D. S. MEYERS,
National Lamp Works, Engineering Department.
Cleveland, Ohio.

Procedure to Follow in Dipping and Baking Armatures

EXPERIENCE gained in the treatment of a large number of motor armatures has indicated certain methods which should be followed to produce the best results. Careful draining after dipping and thorough baking are very important points.

The general process may be divided into two classes, depending on whether the armature requires overhauling or a complete rewinding. Where it is desired to overhaul the recommended steps are as follows:

When the armature is very dirty remove the accumulation of dirt and grease with a scraper. Then clean with benzine or gasoline by brushing or dipping. Remove the bands and insulation on the end windings and make any necessary repairs. Make sure that the core bands are tight and that the coils are tight in the slots. If either is loose, reband, placing a filler in the slot, when required, to get pressure on the coil, at the same time making sure to have the bands down on the iron.

Where wedges are used inspect for tightness, and when it is thought that they will not tighten when dipped rewedge, using fillers under wedges to make the coils tight. Place temporary bands on armatures if there is a tendency for the coils to spring out of position when dipped. So place the bands that the armatures will drain readily after dipping. Some operators may wish to dip and bake armatures without removing bands or hoods. In such cases care must be taken to see that the armatures drain and bake out satisfactorily.

Heat the armature in an oven with freely circulating air, using an oven temperature of 95 deg. to 100 deg. C. (200 deg. to 220 deg. Fahr.) for the length of time given: Armatures below 18-in. diameter, twelve hours; armatures 18-in. to 30-in. diameter, eighteen hours; armatures over 30-in. diameter, twenty-four hours.

It has been suggested by one operator that armatures can be preheated in a storage furnace utilizing the waste heat from the main oven and that thus a saving may be effected, provided that the arrangement can be worked out satisfactorily.

While the armature is still hot dip it in a good grade of baking insulating varnish. A clear amber baking insulating varnish with a specific gravity of 0.835 is recommended, but other varnishes may be used, the specific gravity depending upon the varnish and the thickness of the varnish coat desired. Should the varnish be too heavy thin with benzine. Dip the armature in a vertical position, commutator end up, varnish coming only to the commutator neck, allowing the armature to remain in the varnish for five minutes. If vapor rises from the varnish in large quantities, it indicates that the armature was too warm when dipped. Place all double-commutator armatures in a horizontal position so they can be rotated in varnish to twice the slot depth. In case they cannot be rotated as described, pour varnish over the armature until the windings are filled. After an armature has been dipped wash off the varnish on all finished metal parts with benzine. The commutator should not be immersed as varnish may get inside of the commutator and be trapped, neither draining out nor baking. Such a condition is undesirable. Some operators roll armatures in a tank, instead of completely dipping them, and apparently get good results. When this is done the armatures should be rotated slowly several times to insure that all coils shall be thoroughly soaked with the varnish.

Drain at room temperature until dripping ceases, which will require fifteen to twenty minutes. Place the armature in such a position that there will be no pocketing of varnish in the winding or iron. When the armature is such as to require draining in other than a vertical position, turning will be necessary to avoid the gathering of varnish at one point, the amount of turning depending upon the general construction of the armature. It has been suggested that this draining can be done by spinning the dipped armature in a lathe provided with a shield or cover to catch the surplus varnish.

After dipping and draining bake the armature in an oven at an oven temperature of 95 deg. to 105 deg. C. (200 deg. to 220 deg. Fahr.) until it is dry. This can be determined by taking the insulation resistance. For most cases the length of time given here will be sufficient to dry the armature: Below 12-in. diameter, forty-eight hours; 12-in to 30-in. diameter, sixty hours; over 30-in. diameter, seventy-two hours.

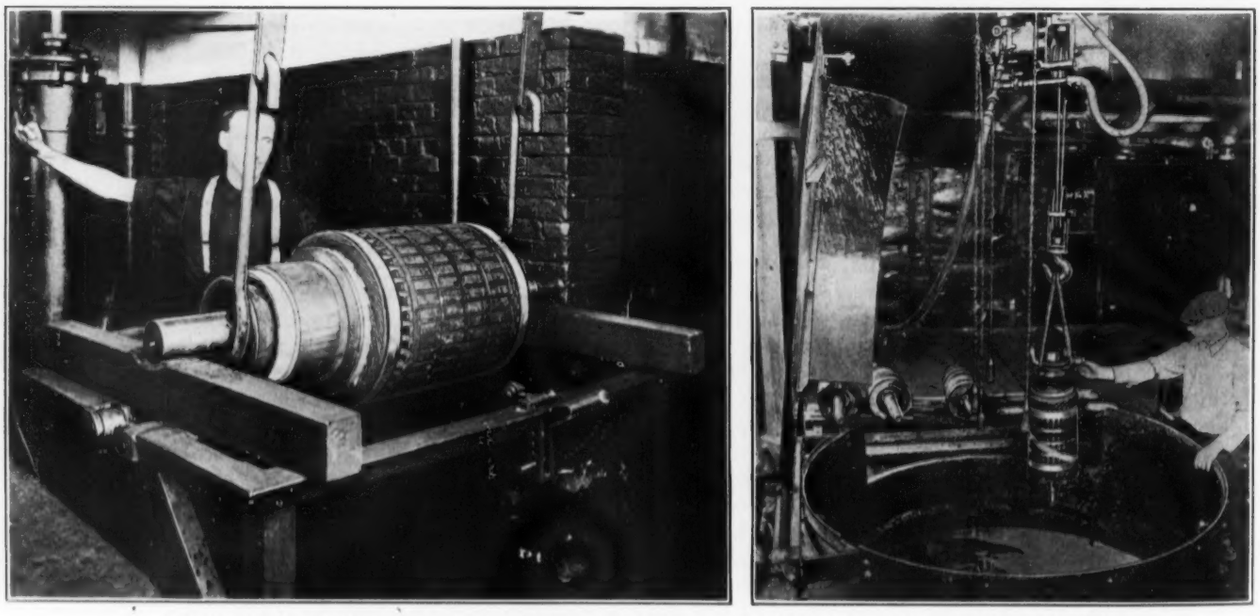
Bake the armature in such a position that there will be no pockets of varnish when it is dry. In baking the armatures in a vertical position care must be taken in placing them in the oven so as to get free passage of air through the air ducts and around them. Ventilation is necessary to attain the best results in baking. When an armature is so constructed that varnish will pocket when the armature is baked vertically, or in the case of dipping and baking with end bands in place, bake in a horizontal position. Such armatures are ventilated with radial air ducts. Arma-

tures baked in this position should be turned during baking to avoid any gathering of varnish at one side.

After taking from oven, true up commutator face and neck, applying hoods at front and rear and the end bands. Fill hoods and coat surface by brushing on baking varnish. Place in oven to set varnish, applying as many additional coats as desired. Undercut the commutator and paint the armature with black air-drying insulating varnish, if a clear varnish has been used and a black finish is desired.

PROCEDURE WHEN ARMATURE NEEDS REWINDING

When an armature requires rewinding the general procedure is the same as for the overhauling, although there are some details connected with the winding work that are of interest. If rewinding is necessary, strip off the coils, clean the commutator and test for short circuits or grounds and clean the iron. Straighten bent punchings and file off any rough surface. Wind the coils on the core, making sure that they wind snugly into the slot, using such winding cells and filling pieces as are necessary to make them tight. Wind the top part of the coils high enough in the slot for the core bands to exert a pressure on the coils when down on the core. Place leads down in an even manner so there will be no crosses in the leads. Use such insulating material as is necessary at points where there may be danger. After the top leads have been put down plug the commutator and solder.



DIPPING MAY BE DONE WITH THE ARMATURE IN EITHER A HORIZONTAL OR A VERTICAL POSITION

After soldering place the armature in oven for eight or ten hours for heating before banding. If the coils are high and it is thought that it will be difficult to get them down and also have tight bands, run on temporary bands. Use material enough under bands to insure that the wire will not damage the winding. Place the bands so that there will be no tendency for the varnish to pocket during dripping and baking.

If no temporary bands are needed, the permanent bands can be placed on the core, and if the armature is baked in a vertical position, the hood and end band that are up during baking can be applied if desired.

Dip and bake the armature according to the method previously outlined. After dipping and baking, turn the commutator and neck and put on the hood, insulation and permanent bands, treating the armature as recommended for overhauled armatures. Finish the completed armature in the same manner as before.

The dipping tanks should be made of sheet metal (preferably steel) of a thickness sufficient to retain the dipping compound without buckling. It should be made water-tight by welding the edges. Some tanks have been equipped with covers that are released in case of fire by the melting of a fusible wire, thus releasing a latch and dropping the cover automatically, which quickly smothers the flame. When large tanks are used with heavy covers it is somewhat more convenient to make the cover removable altogether. With this type of tank it is advisable to provide a cistern outside of the building, connected to the tank by a pipe line provided with a valve in case of fire that can readily be opened, thus emptying the dipping compound into the cistern. In connection with the dipping tank it is necessary to provide a suitable rack on which to drain armatures after the dipping process. This can take the form of a rack placed over the tank or built at the side of the tank with a suitable drain connected.

Although the practice and recommendation of the Westinghouse Electric & Manufacturing Company is to dip the armatures, a number of operating companies find it more convenient to roll their armatures in a pan or trough. By the use of this method they report very good results in service. These troughs in some cases are made of wood set on the floor and ends of troughs are used to support armatures while being rolled. Another type of tank shown in an accompanying illustration is made of sheet steel. This tank is swung on a stand that supports the armature and is raised and lowered by means of a lever.

In connection with the apparatus used to raise and lower the armatures it is recommended that an air hoist or a differential chain hoist be used in preference to an electric hoist in the vicinity of the dipping tank. A slight spark in the electric hoist may be the means of igniting the explosive mixture produced above the tank

by the vaporization of the benzine. A type of truck for draining and to hold the armatures during the baking process in a vertical position is shown below.

Two grades of dipping varnish commonly used in connection with the process of dipping and baking armatures are marketed—one with a china-wood-oil and the other with a linseed-oil base. Our company has used

THOROUGH BAKING IS ESSENTIAL IF GOOD RESULTS ARE TO BE EXPECTED

both as either one is suitable for this work. At present we are using a clear varnish which has a china-wood-oil base because it tends to dry out more uniformly and has a less injurious effect on built-up mica parts. The solvent for both of the above makes of varnish is benzine.

Ovens for this work have been made of wood lined with asbestos, sheet iron, cement or brick and heated by either steam, hot-air furnaces or electricity. This variation in the design depends largely on local conditions.

Formerly it was the practice to bake armatures at 125 deg. C. (257 deg. Fahr.) from twenty-four to forty-eight hours, depending on the size of the armature. This has recently been changed to a baking temperature of 95 deg. to 105 deg. C. (203 to 221 deg. Fahr.) from forty-eight to seventy-two hours. The lower temperature and longer baking time give the better results as the danger of taking the life out of the insulation is removed and the varnish bakes more evenly, the surface setting less rapidly. It is recommended that the lower temperatures be used in the belief that the best results will be obtained.

JOHN S. DEAN,
Motor Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Speed of Small Motors Determined by Rotating-Disk Comparison

A PROBLEM which often confronts the electrical engineer is that of measuring the speed of very small motors running at a high rate. Tachometers are available reading as high as 10,000 r.p.m., but even the best of tachometers consumes sufficient power to slow down a small motor considerably. Sometimes the motor may be so mounted that it is not convenient to attach a tachometer. The ideal method for rating such motors would be one which would not require any mechanism to be attached to the motor itself and the speed of which would therefore not be affected in this way. The method should be sufficiently flexible to cover a wide range of speeds.

The writer has been using for some time a stroboscopic method for rating small motors which satisfies the above requirements. This method employs a second spindle capable of being rotated at a variable speed. The spindle is adjusted to rotate synchronously with the motor under test at any speed which may be chosen, such as one-half, one-third or one-quarter the motor speed. The speed of the spindle is then found with a tachometer or speed counter and multiplied by the proper ratio.

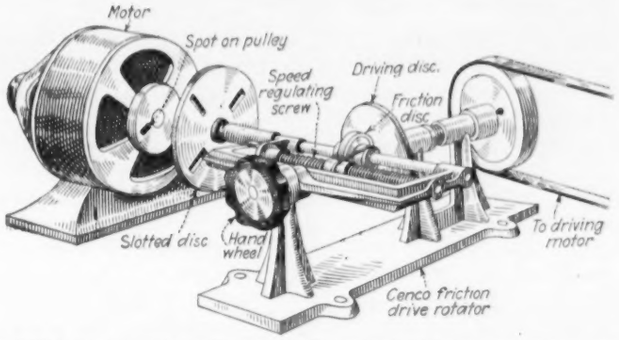
The apparatus employed and the method of synchronizing used in making this test are as follows:

A small spot, such as a chalk mark or a small paper sticker, is placed on the armature or pulley of the motor. A disk having two or more radial slots, symmetrically disposed, is mounted on the spindle of a "Cenco" friction-drive rotator. As the number of slots in the disk determine the ratio between the speed of the disk and that of the motor, the number of slots used depends on the speed of the motor under test. The rotator is driven by a constant-speed motor and is so arranged that the spot described above can be observed through the slots in the disk.

The motor under test is allowed to come up to constant speed. The rotator is then started and gradually speeded up by means of the friction-drive mechanism. Meanwhile the spot on the small motor is observed through the slots in the rotating disk. A convenient arrangement of motor and rotator is shown in the accompanying drawing.

When a synchronous speed has been reached only one spot is seen, and it is apparently standing still. This means that one slot passes the eye of the observer for each revolution made by the motor. The speed of the spindle of the rotator—*i.e.*, the speed of the disk—is then measured with a speed counter or tachometer.

This speed multiplied by the number of slots in the disk gives the speed of the motor under test. For example, if the rotator when synchronized is found to have a speed of 1,500 r.p.m. and the disk used has four slots, the speed of the motor is 6,000 r.p.m. Even if the speed of the motor is fluctuating, this method can still be used, provided that a direct-reading type of



WHEN DISK REVOLVES AT SPEED PROPORTIONAL TO THAT OF MOTOR THE SPOT ON PULLEY APPEARS STATIONARY WHEN VIEWED THROUGH SLOTS

tachometer is employed. In such a case the speed of the rotator is adjusted from time to time to correspond with the speed of the motor, and the corresponding readings of the tachometer are noted.

Central Scientific Company, W. H. FARR,
Chicago, Ill. Physical Engineer.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Specific Bill Form Makes Coal Clause Understandable

THE Trinidad (Col.) Electric Transmission, Railway & Gas Company has a rate for power service which includes a fuel-cost clause in addition to which are a demand charge and an energy charge based on pre-war coal cost.

Altogether these charges make for a complicated

TRINIDAD, COLO. .....

.....

.....

OR TO

THE TRINIDAD ELECTRIC TRANSMISSION, RAILWAY AND GAS CO.
TRINIDAD, COLORADO

DATE | ELECTRIC POWER SERVICE AT | FOR MONTH OF January 19 21

Meter No. 640

1 - 31 21 Reading 932
12 - 31 20 Reading 792
140 x 480 = 67,200 K. W. H

Meter No. .....

Reading .....
Reading .....
Constant
x = ... K. W. H.
Total = ... K. W. H.

Demand Meter No. 640 Reading 0.7
Demand = 0.7 x 480 = 336 K. W.

SERVICE CHARGE
300 K. V. A. Station — 510 00
36 K. W. Excess Demand @ $1.00 per K. W. — 36 00

ENERGY CHARGE
67,200 KWH @ 1-1/3 c per K. W. H. — 896 00
1,242 00
67,200 KWH @ .659019 c per K. W. H. — 442 86
TOTAL BILL — $1,684 86

*Average coal cost per ton $ 3.99675
Base coal cost per ton - - $ 1.50
Difference $ 2.19675

Rate = .60c x 21.9675 = .659019 c per K. W. H.

Made by ..... Checked .....
Meter Readings Verified ..... Approved .....

FORM OF BILL WHICH SHOWS CLEARLY HOW COAL COST IS CALCULATED

billing. Were it not for the clear and specific form used, as shown herewith, numerous complaints might be registered by some of the forty large consumers receiving this form of bill.

On each bill is first calculated the kilowatt-hours used and the maximum demand. From the latter the excess demand over the normal or contracted demand for the size of the installation is calculated and billed at $1 per kilowatt. Next is added the charge of $0.01⅓ per kilowatt-hour for energy consumed. From the average cost of coal during the month is subtracted the pre-war coal cost—$1.50 per ton—and this difference is multiplied by $0.0003, which gives the increased charge per kilowatt-hour of energy consumed. In the case illustrated the increased cost was $0.00659019 per kilowatt-hour.

The coal clause on which this billing is based reads in part as follows:

The rates for energy under this schedule are based on an average cost of coal of $1.50 per ton of 2,000 lb., f.o.b. the Trinidad and Walsen plants of the power company. Should the average cost of coal purchased by the power company for use as above set forth during the month for which the bill for service and energy is rendered be less than $1.50 per ton, the bill for service and energy shall be decreased by an amount representing a decrease in energy charge computed at the rate of three-tenths of one mill per kilowatt-hour for each 10 cents decrease in the average cost of coal below $1.50 per ton for the month covered by the bill in question; and, correspondingly, should the average cost of coal purchased by the power company be more than $1.50 per ton, the bill for services and energy shall be increased by an amount representing an increase in energy charge computed at the rate of three-tenths of one mill per kilowatt-hour for each 10 cents increase in the average cost of coal above $1.50 per ton for the month covered by the bill in question.

Valuation and Rate of Return of Public Utilities

OF THE many problems which confront operators of public utilities, those of valuation and rate of return stand out most prominently, declared Robert A. Brown, attorney for the St. Joseph Railway, Light, Heat & Power Company, in an address on "Methods of Valuation and Rates of Return of Public Utilities," at the recent meeting of the Missouri Association of Public Utilities in Kansas City. What is the correct method of arriving at the present fair value of the property of a utility for rate-making purposes? Shall this value be fixed upon the basis of original cost? Shall average prices prevailing over a fixed period of years control or shall the property be valued upon the basis of the present reproduction cost? These are questions, he stated, over which the owners of utilities, public service commissions and the courts of the country have contended for a period of years since the decision of the Supreme Court of the United States in the pioneer case of Smyth vs. Ames.

Mr. Brown continued:

Since the rendition of that decision the Supreme Court has in a long line of decisions apparently intended to say that such properties must be valued for rate-making purposes upon the basis of the reproduction cost thereof new at the time the rates are to be fixed. While the utterances of the Supreme Court are not definite and explicit in announcing a fixed rule by which the properties of utilities are to be valued, we believe that after due consideration of all its decisions no conclusion can be drawn other than that the court has intended to approve the reproduction-cost-new method.

The time is here when the courts, public service commissions and legislative bodies must realize that the public utilities of the country must be placed upon the same economic basis as other industries. The property of every other industry and of every individual is worth just what it would cost to reproduce it, and by what method of reasoning may it be said that a different rule should apply to the property of utilities? Such property does not belong to the public any more than does the property of a banker, merchant or manufacturer.

Should a utility company purchase a site for a power house, paying therefor the sum of $100,000, and should the

value of the property increase 100 per cent before the power house was erected, is there any sound reason why the company should not be permitted to sell the power-house site for $200,000, if it could buy another site equally good for $100,000? If it should then invest the $100,000 profit made upon the real estate deal in new equipment, should it then be permitted to earn a reasonable return upon such additional investment? If so, why should it not have been allowed to earn a reasonable return upon the fair value of the original power-house site purchased by it, should it have retained title thereto and should its value have remained at $200,000?

The properties of public utilities are always to be valued at the time rates are to be fixed, and a return is supposed to be allowed upon the fair value of the property at that time. Under such circumstances it would seem wholly immaterial what the property originally cost. The question is, What is the property reasonably worth at the time rates are to be fixed?

One of two things is certain—either the property of utilities must be valued upon the basis of reproduction cost new or else the rate of return allowed upon the original cost should be doubled during the period of inflated property, material and labor values and the depreciated value of the dollar. If a return of 7 per cent was reasonable on a pre-war basis, a return of 14 per cent would not be unreasonable under modern conditions. No one, however, would be foolishly optimistic enough to hope that any rate-making body, necessarily influenced as they always are to a greater or less degree by political considerations, would ever permit a return of 14 per cent to be earned and retained. It seems essential, therefore, that utilities, if they are to secure any adequate return upon their investments, must insist that their properties be valued upon the basis of reproduction cost new.

In this connection it must be remembered that all utilities are regulated by public authorities and rate-making bodies, and that the property of a utility can always be revalued and its rate of return fixed and changed as conditions and circumstances may warrant.

While the method of valuation suggested may not be without serious objections, it nevertheless seems to be the only method by which utilities can hope to be permitted to earn any substantial return upon their properties.

While the question of valuation is vital, the rate of return a utility is to be permitted to earn must finally determine whether these products of modern civilization are to continue to be owned and operated as private enterprises or whether they are to be taken over by the government, the states and the municipalities and operated at the expense of the people as political spoils and adjuncts.

If a private enterprise is to continue the operation of utility properties, investors must necessarily be reasonably assured of a fair return upon their investments. It will not be sufficient to say to them that they may be permitted to earn as much as a 7 per cent return so long as the chances remain ten to one that they will not only not earn a 7 per cent return, but that they will lose the original investments made by them.

The people are not easily educated, especially upon subjects about which they do not wish to be enlightened. It will therefore be necessary that they believe themselves to be personally and individually interested in the utilities before they can ever be induced to permit such utilities to earn a sufficient return to justify and induce the investment of private capital. Then, and not until then, it may be possible to devise some method whereby utilities can be guaranteed a low rate of return upon the fair values of their properties and receive a reasonable chance to earn a very substantial increase in addition thereto. One-half of this increased return should be paid to the government, the state or municipality, as the case may be, and the remaining one-half should be retained by the utility. Personally I can conceive of no other solution of the problems that now confront the utilities of the nation. Under the method named, efficient management and operation would be assured, and an abundance of capital would be thereby attracted.

Unless the people and their official representatives are willing to become in a measure partners with the utilities and to aid in devising ways and means whereby reasonable returns may be expected from their operation, then of necessity they must in the near future pass to the scrap heap, and we will enter upon an era of political and socialistic government ownership, which in turn must finally bring about fundamental changes in our form of government and lead it at least to the very brink of destruction.

Relation of Water Power to Industrial Development in California

THAT industry is the best guarantee of the permanence and prosperity of a community, a state or a nation was emphasized by W. E. Creed, president of the Pacific Gas & Electric Company, in a recent article in the company's magazine, *Pacific Service*. Discussing the relation of water power to industrial development in California, he said:

"Many factors aid in industrial development, but of all factors population and power are indispensable. Population furnishes the labor supply and the immediate local markets, but population will not alone suffice. In modern times no great industrial structure can exist without power. It must be available to turn wheels, to transport goods and to render countless other services to industry.

"The possession of raw materials, while not essential, is nevertheless a great stimulus to the development of manufactures. All the nations of Europe are densely populated, and the world war disclosed the great importance these nations attached to power and raw materials, particularly to the sources of power to be found in oil and coal. They know that with population and cheap power industrial development is certain even without raw materials, as great masses of people must secure raw materials either in manufactured form or in the raw state to be manufactured, and usually the course is for raw materials to be manufactured into usable products at centers of population regardless of the place of origin. But if in addition to population and power, raw materials are also at hand, the most favorable conditions exist for manufacturers to develop and flourish.

Industrial Activity and Growth Dependent on Power

"California has in the last ten years made a great gain in population. In addition, it possesses most of the basic raw materials necessary for manufacture. The third thing needed by California for unrestricted industrial development is power. A brief survey of the history of manufactures in California discloses that prior to 1900 the state was comparatively unimportant as a manufacturing state, but that it now produces more manufactures than all the other Western states combined. This remarkable improvement in industrial position is directly traceable to the California oil industry, which began about twenty years ago to furnish cheap oil, from which cheap power could be developed. In the past fully 60 per cent of the power used in California has come from oil. The supply is limited, and every barrel of oil used decreases the available supply. As a result, the oil industry is carrying a burden beyond its capacity and must be relieved.

"California has no coal supply of good quality. The old days of 40-cent oil are gone. The only sound solution for the power needs of California lies in the de-

velopment of hydro-electric power. There is no cheaper power available, and if the development of water power proceeds unhindered, it will be the impulse for a wonderful economic growth in the state, from which will come further great gains in population and wealth. The advantages will accrue not only to the large centers of population but to every part of the state. Markets for the product of the farmer will increase, and money available for investment in and development of agricultural lands and communities will be abundant.

"The extent to which California can develop industrially with adequate water power is almost without limit. Its geographical position on the Pacific gives it opportunity for trade with Pacific countries, its population affords the necessary local markets, and it possesses nearly all the basic raw materials. They may be roughly classified as lumber and forest products, agricultural products, fisheries, and mines and minerals including petroleum. These materials for manufacturing, of which perhaps the most important is the product of agriculture, place the state in a position, having cheap power, to develop and extend most advantageously the packing, canning, preserving, milling, lumber, chemical, fabric, leather and metal industries and a long list of secondary industries.

PUBLIC CO-OPERATION NEEDED

"The question naturally occurs whether the State of California, having the great advantage of population and raw materials, is in a position to develop the necessary hydro-electric power. There is no question at all that favorable physical conditions exist. What is most needed is the co-operation of the public and an understanding by the public of what the development means in order that it may be stimulated and encouraged.

"Careful studies indicate that there is possible of development in hydro-electric power in California 9,250,000 hp., of which only 942,000 hp. (a little over 10 per cent) is thus far developed. The potentiality of the state for power development is relatively strong. The total maximum horsepower in water in the whole United States is 59,369,000 and in the eleven Western states is 42,850,000. California thus possesses about 15 per cent of the total possible hydro-electric development in the entire country, and about 23 per cent of the possible hydro-electric development in the Western States.

"The power companies of the state are not unmindful of the need for power. The combined construction programs of all the California power companies contemplate the development of about 2,000,000 hp. in the next ten years. This development, if carried out, will require an expenditure of $500,000,000 to $800,000,000 during the period of construction. Probably $600,000,000 is a close estimate of the amount of new money required.

"Will this amount of power be necessary? If growth continues in the future at the same rate it has in the past, the state will require about 100,000 hp. additional each year. If, in addition to taking care of the normal growth and development based upon the rate of progress in the past, the water-power companies are to relieve the oil industry of some of its burdens in order to reduce the cost of power and preserve for other uses the oil supply for which there is no substitute, then the additional amount of power required will be greater than 100,000 hp. per annum. At the present time the users of hydro-electric power are distributed in about the following percentage: Lighting, all classes, 13.6; commercial and industrial power, 45.7; agricultural power, 12.9; railway power, 27.8.

"Increased demands will come from (a) normal increase in the needs of present users; (b) the substitution of water power for oil in many branches of industry; (c) new industries, and (d) new uses for power. Aside from the demand for water power to displace oil, the greatest use in the future will probably come from the agricultural industry. The best available data indicate that there are 22,000,000 acres of cultivable land in the state out of a total of 101,800,000 acres. Of the 22,000,000 acres suitable for cultivation, approximately 4,000,000 acres are under cultivation, including all the irrigated lands. At present there is installed for irrigation purposes in the state a capacity of about 275,000 hp.

"If within the next ten years, as a reflex of the industrial growth of the state, the entire 22,000,000 acres of land be put under irrigation, the power installation required will probably equal about five times the present capacity installed for irrigation purposes.

"The whole state should be animated by a spirit of co-operation toward water-power development. The destiny of California as an industrial empire will be hastened or delayed as its people encourage or discourage the invitation to capital to support projects to harness the mountain waters. In truth, the future of California will be measured in terms of horsepower from hydro-electric development."

Citizens Appointed Custodians of Street Lights

AN EFFECTIVE means of insuring the assistance and co-operation of the public in keeping street lights burning, by appointing citizens as custodians of certain lights, has been adopted with great success by the Willamette Valley division of the Portland (Ore.) Railway, Light & Power Company. This was accomplished by sending the following letter to the citizen who lived nearest to a given street light, provided that he had a telephone, the nearest citizen with a telephone being selected in the other case:

"We want to keep as many of the street lights burning every night as possible. We must depend to a large extent upon the public to let us know when the lights do not burn. 'What is everybody's business is nobody's business.' Hence frequently we are not advised when lamps are out. May we appoint you custodian of the light at No ——— and ask you to call Main 55 and let us know when it does not burn."

Inclosed with the letter was an acceptance postal card.

There is a penalty clause in the company's contract with the city, but it was felt that the good will that would be engendered by showing that the company really wanted to keep its lights burning continuously was of greatest importance. The responsibility thus placed upon individuals has in many cases had the psychological effect of causing the individual in question to feel that he or she is a part of the company's organization and therefore to take a corresponding attitude in other matters relating to the company's business.

W. M. HAMILTON,
Manager Willamette Valley Division.
Portland Railway, Light & Power Company,
Portland, Ore.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Motors, Generators and Transformers

Use of Synchronous Motors for Power-Factor Correction.—RENÉ MARTIN.—The use of synchronous motors for improving power factor by overexciting is taken up in detail and the various phases of their application are indicated. From an economical standpoint it is shown that such means are the best for the purpose. Finally the matter of regulating the voltage at the end of a long line by means of synchronous machinery is considered.—*Revue Générale de l'Electricité,* Feb. 12, 1921.

Rotary-Converter Practice.—A. BARJON.—In this article the author gives an excellent and quite exhaustive account of the principle and the operation of the modern converter. It has been written in such a simple and thoroughly practical manner as to make it useful for any substation operator. There are eight chapters touching upon the most important points, such as the commutation principle, operation as synchronous motor, operation as direct-current generator, starting methods, synchronizing, voltage regulation and efficiency.—*L'Electricien,* Feb. 1 and 15 and March 1, 1921.

Continuous Rated or 50-Deg.-Rise Motors.—L. F. ADAMS.—In this paper the author sets forth the case for the 50-deg.-rise motor as distinguished from the 40-deg.-rise motor.—Paper presented before Association of Iron and Steel Electrical Engineers, March, 1921.

On the Design of Split-Phase Motors.—E. A. BINNEY.—The writer gives a method of calculating the starting performance of split-phase motors for labor-saving devices requiring only fractional horsepower. A method of calculating the starting performance of such motors is given.—The London *Electrician,* March 18, 1921.

Lamps and Lighting

Use of the Pintsch "Glim" Lamp for Switch Circuits.—DR. SCHRÖTER.—If two metallic electrodes are introduced into a glass bulb containing a rarefied atmosphere of neon or helium and a direct-current voltage of at least 160 volts is impressed upon the two electrodes, the negative pole will emit a distinctly visible light, which at about 220 volts becomes so bright that such a lamp may be used advantageously for signal purposes on switches and similar apparatus. On alternating-current lines both electrodes show the light emission. A great variety of such lamps were recently introduced commercially by the Julius Pintsch company of Berlin. The resistance of the lamps, as defined by voltage impressed and current passed, is not fixed but varies with the intensity of discharge; that is, the more current is passed the less the resistance becomes. A lamp for 20 milliamperes direct-current passage has about 10,000 ohms resistance. A passage of even a fraction of a milliampere shows a distinctly visible luminescence. In general a consumption of from 4 watts to 5 watts is fully sufficient. Among the many possibilities inherent in the use of such lamps these may be enumerated: Parallel with a fuse it detects and shows a burn-out; it will serve as a position indicator for switches or as a distant indicator of the condition of a motor; put in series with a condenser it limits the charge or discharge energy; put in series with an X-ray tube the luminosity of the "glim" lamp becomes a measure of the current passed by the tube; in series with a selenium cell the combination permits the observation of the density of general illumination at some distant point; it facilitates the steady control of fire-alarm systems, and it serves as a polarity indicator.—*Elektrotechnische Zeitschrift,* Feb. 10, 1921.

Generation, Transmission and Distribution

Checking Up on Automatic Substations.—CHARLES H. JONES.—A complete and detailed study of the functioning of the equipment in the substations on the Chicago, North Shore & Milwaukee Railroad. It is shown that from 1915 to 1920 the kilowatt-hour consumption per car-mile on this interurban system has been reduced from 5.78 to 4.31. The efficiency and distribution losses in three stations were analyzed by means of test runs, the results of which are given in the article.—*Electric Railway Journal,* March 26, 1921.

Speed Regulations of the Hydraulic Turbine.—RAYMOND D. JOHNSON.—Some consideration is given to the governor action, but the principal discussion is directed to the use of surge tanks in hydraulic systems.—*Journal Engineers' Club of Philadelphia,* March, 1921.

Points to Consider in Using the Wind as a Source of Power.—PAUL BASIAUX.—With the ever-increasing demand for power it has come to be a practical idea to study the possibilities of utilizing the wind as a means of generating power. Some general information is given regarding the available power in the wind, and many of the points to be considered are presented. As a means of taking care of the condition brought about by the varying velocity of the wind it is suggested that possibly storage of power by means of compressed air might be feasible.—*Revue Générale de l'Electricité,* Feb. 12, 1921.

The Hydro-Electric Power Scheme at the Nore Falls.—Description of a new hydro-electric plant on the Laagen River, some 50 miles (80 km.) from Christiania. It is asserted that the ultimate development will include twelve Pelton wheels of 21,500 hp. each operating at 300 r.p.m. under a head of 1,119 ft. (341 m.). The generators are 12,000-volt, 50-cycle machines, and energy is stepped up to 110,000 volts for transmission.—London *Engineering,* March 4 and March 18, 1921.

Determination of Sag of Heavy High-Voltage Lines Suspended on Disk-Type Insulators.—H. SCHENKEL.—A new method is given to predetermine the sag, considering the string of disk insulators as a flexible part of the line which assumes a catenary curve form and may be calculated according to the laws of such

curves. Several practical examples are figured out. The formula given applies only if both ends of the span are located at the same elevation.—*Elektrotechnische Zeitschrift,* Feb. 17, 1921.

Traction

Portable Bond Testers.—G. H. McKelway.—Portable instruments are said to afford the most effective means for testing bonds in order to locate those in poor condition. With the portable set described in this article it is shown that convenient tables may be supplied the men making the tests in order to minimize calculations in the field.—*Electric Railway Journal,* March 19, 1921.

Swiss Electric Locomotive Progress.—Details are given of recent locomotives equipped by the two leading builders of electrical apparatus in Switzerland—namely, the Brown-Boveri and Oerlikon. Particular attention is given to the machines for the federal railways. Some experiments with new types of drive are included, indicating a leaning toward gears as a substitute for side rods.—*Electric Railway Journal,* April 16, 1921.

Branch of St. Paul Railroad Electrified.—The freight on the old Chicago-Evanston Branch of the St. Paul Railroad is now handled electrically by the Northwestern Elevated Railroad. The overhead construction of this electrification is described in this article.—*Electric Railway Journal,* April 2, 1921.

Installations, Systems and Appliances

Magnetic Plate-Handling Crane.—The importance of the magnetic crane for handling steel plates in shipbuilding, boiler-making and similar plants is emphasized, with a description of one type used in the British industries.—London *Engineer,* March 18, 1921.

The Performance of Electric Furnaces.—This table is said to represent the cost of producing electrical steel from small furnaces of from 1 ton to 3 tons in England when labor prices were at the 1919-1920 level.—London *Engineering,* March 4, 1921.

PERFORMANCE OF ELECTRIC FURNACES

	—Continuous Running—			—— Single Shifts ——		
	£ s. d.	Per Cent		£ s. d.	Per Cent	
Scrap and metallic and slag-forming additions	6 0 0	41.78		7 10 0	41.1	
Electrodes	0 18 0	6.27		1 5 0	6.85	
Power	3 12 0	25.08		4 15 0	26.05	
Labor	2 0 0	13.93		2 10 0	13.7	
Electricians, yard staff	0 12 0	4.18		0 15 0	4.1	
Maintenance and stores	1 5 0	8.71		1 10 0	8.22	
Totals	£14 7 0	99.95		£18 5 0	100.02	

Automatic Speed Control for Sectional Paper Machine Drive.—Stephen A. Staege.—The advantages of electric drive for paper machines are set forth, and control of motors is dealt with more particularly in regard to speed control.—*Electric Journal,* March, 1921.

Electric Smelting of Pig Iron at Domnarfvet, Sweden.—Gerard de Geer.—The early operations at the Domnarfvet Iron Works and conditions inducing the adoption of electric furnaces are dealt with. It is said that the possibilities of using non-charcoal reducing agents and pit instead of cast furnaces are still in the research stage.—*Chemical and Metallurgical Engineering,* March 9, 1921.

Battery Charging for Industrial Trucks and Tractors.—Charles A. Rohr.—While the equipment for charging storage batteries for industrial trucks and tractors naturally varies with the number of vehicles in use, the size and number of their batteries and the form in which the energy is purchased, the writer concludes that a motor-generator set with control suitable for charging by the constant-current or series-resistance method is advisable in most cases.—*General Electric Review,* April, 1921.

Brief Directory of Material-Handling Apparatus.—R. H. McLain.—The article is intended to assist in making the selection of equipment which is best suited for material handling in any particular case. It presents in condensed form descriptions and illustrations of a large number of electrically driven freight-handling devices which are suitable for handling almost all classes of materials through horizontal and vertical motions over long and short distances.—*General Electric Review,* April 1921.

Electrophysics and Magnetism

Magnetic Susceptibility of Low Order.—E. Wilson.—The author deals primarily with the subject from the standpoint of practical application. The magnetic properties of certain minerals can be changed by oxidation or reduction. Rock susceptibility is studied in view of its bearing on magnetic survey work. A knowledge of the subject, the author says, is particularly necessary to those engaged in the construction of scientific instruments.—London *Electrician,* March 11, 1921.

Effect of Rate of Cooling on the Magnetic and Other Properties of an Annealed Eutectoid Carbon Steel.—C. Nusbaum and W. L. Cheney.—This paper discusses the results of a study of the effect of the rate of cooling upon the magnetic and other properties of an annealed eutectoid steel. In carrying out the experiment six specimens of this steel were selected, heated to 800 deg. C. and allowed to cool at various rates—one in air, another in lime, and the remainder in the furnace at slower and slower rates. The following properties were then measured: Normal induction for ordinary and large magnetizing forces, residual induction, coercive force, resistivity, and Shore scleroscope hardness.—*Scientific Paper No. 408, U. S. Bureau of Standards.*

Electrochemistry and Batteries

Apparent Irreversibility of the Calomel Electrode.—A. W. Laubengayer.—Tests to determine whether the irreversibility of the calomel electrode is real or only apparent. The observed phenomena of irreversibility are explained as due to the formation of an absorbed film of mercurous chloride on the mercury anode, which offers high resistance to the passage of the current. A current of 0.2 milliampere can pass before the film forms. A number of points are not yet cleared up and call for further study, it is said.—From paper presented before American Electrochemical Society, April 21, 1921.

Phenomena of Arc Welding.—O. H. Eschholz.—A detailed discussion of metal deposition, fusion and arc stability during electric welding. Under the first item there are discussed the function of transport of metal by molecular forces, effect of evolution of gases, and vaporization or condensation, with the conclusion that the molecular forces play the main part. Under fusion are considered the effects of impact of ions, atmospheric convection currents, sudden liberation of gases, and combination of material with oxygen and nitrogen. Arc stability is discussed from the standpoints of long and short arcs, constant potential circuits, use of ballast resistance, etc.—From paper presented before American Electrochemical Society, April 21, 1921.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

City in Error in Taking Rate Case to Courts First

NEW YORK CITY erred in applying to the courts for an injunction to prevent local electric lighting companies from raising the rates instead of taking the matter up first with the Public Service Commission. Such was the unanimous opinion handed down last week by the Appellate Division of the Supreme Court of New York in setting aside the injunction previously granted by Supreme Court Justice Cohalan in favor of the city of New York, restraining the New York Edison Company and the United Electric Light & Power Company from putting into effect increases in rates in proportion to higher coal costs.

Coal riders were extended to all consumers on Dec. 1 providing for a charge of fifty-one-thousandths of a cent per kilowatt-hour for each 10 per cent advance in the price of coal above $3 per ton, the average price in effect when the previous rate schedule was authorized. The companies' rates had remained unaltered from the first of July, 1917, when they were reduced from 7½ to 7 cents per kilowatt-hour. At that time the two companies reserved the right to go back to 8 cents if conditions were reversed. The increased coal cost actually made it necessary to bring the rate to 7.9 cents.

The new schedule was filed with the Public Service Commission on Nov. 1, and it was not until after the new rate had gone into effect on Dec. 1 that the city officials tried to prevent it. Without attempting to obtain a hearing before the commission the city immediately applied to the courts for an injunction.

Mouth-of-Mine Plants Found Impracticable for Superpower Project

SUFFICIENT progress has been made in the Boston-Washington Superpower Survey to determine that it is impracticable to locate large power plants either at the mine mouth or elsewhere in the coal-mining regions because of an insufficiency of water available for condensing purposes. It is estimated that 800 tons of condensing water is required for each ton of coal put under boilers. There are no streams in the mining districts that could be relied upon to furnish the quantities of water that would be required by plants of the size contemplated. Even the large near-by rivers seem to have been eliminated from the consideration. The eastern branch of the Susquehanna River is said to carry too much sulphur to allow of its successful use in connection with a large power plant. The Delaware River would be eliminated, it is believed, because the storing and discharging of water in connection with the operation of a large plant would induce an irregular flow of the river which would interfere with its use for power purposes.

It also has been demonstrated that the steam sizes of anthracite coal are too valuable to be considered as fuel at a superpower station. No one mine would be able to provide sufficient culm or waste coal for the operation of such a plant.

Iowa Conflict Due to Misunderstanding

IN CONNECTION with the veto of the Iowa utility court bill, for which the electric light and power companies of the state blamed the electrical contractors, as reported in last week's issue, W. H. Morton, general manager of the National Association of Electrical Contractors and Dealers, made the following statement this week to the ELECTRICAL WORLD:

"The National Association of Electrical Contractors and Dealers has investigated the Iowa situation, and whatever action was taken was apparently due to a misunderstanding of the provisions of the bill and was contrary to the declared policy of the national association as expressed in the resolution of the national executive committee passed at the January meeting this year in which the association pledged itself to do everything in its power to promote public good will toward electric light and power utilities.

"Steps are now under way for a conference committee of the Iowa utilities and contractors to adjust the misunderstanding. A survey of the situation leads the national association to believe that opposition of the municipalities was the deciding factor in causing the Governor's veto."

Electric Utilities' Coal Stocks in Good Shape

BITUMINOUS coal stocks held by electric utilities are in strong shape. This is indicated by the preliminary report on commercial stocks of coal as of April 1, 1921, made by the Geological Survey.

Returns from 241 electric utilities showed a stock on hand on April 11 of 2,116,000 tons of bituminous coal, against 2,068,000 tons Jan. 1, 1921; 1,098,000 tons June 1, 1920; 1,081,000 tons March 1, 1920; 2,013,000 tons April 1, 1919, and 2,112,000 tons Jan. 1, 1919.

The report states that in comparison with 1920 public utility coal stocks showed an improvement in virtually every state, while the Appalachian, Middle Atlantic and New England States and much of the Great Lake docks territory recorded increases over even April 1, 1919.

In speaking of the general situation with respect to coal production and consumption, the report brings out facts disproving the alarming reports that have sprung from interested sources regarding a pending coal shortage. In this connection the report says:

At first thought this profound slump in production might give ground for alarm as to the sufficiency of next winter's supply of coal. Before, however, it is assumed that the slump in output foretells a shortage of coal two other facts must be taken into account. The first fact is that

the slump was preceded by several months of heavy production, which brought the total output in 1920 up to 556,000,000 tons, exceeding even the war year, 1917, and approaching the record production of 1918—579,000,000 tons. Not all of this large output was consumed or exported. Some millions of tons of it were added to consumers' stocks, and it was to be expected that these stocks would be drawn upon during the late winter. The second fact to be remembered is that the slump in output was accompanied by a great cut in consumption. While complete data on current consumption are lacking, there is enough evidence to show that the combined domestic consumption and exports during the first quarter of 1921 were 20 per cent less than during the first quarter of 1920. Comparing the month of March, 1921, with March, 1920, the decrease was about 30 per cent.

I. E. S. to Retain Part of Present Quarters Another Two Months

AT A MEETING last week of the board of directors of the United Engineering Societies and the Illuminating Engineering Society it was decided that the latter should relinquish one of the two rooms it now occupies in the Engineering Societies Building in New York to the National Electric Light Association. The other room is to be retained by the Illuminating Engineering Society for a period of two months or so to allow the United Engineering Societies more time in which to procure if possible other accommodations for the society in the building.

Customer Ownership Committee "Gets Busy" in New England N. E. L. A.

TO "SELL" the idea of customer ownership among New England electrical utilities a committee has been formed in the New England Division of the National Electric Light Association, consisting of P. H. Whiting, Central Maine Power Company, Augusta, Me., chairman; Franklin L. Hall, Narragansett Electric Lighting Company, Providence, R. I.; William Gould, Gas & Electric Improvement Company, Boston, and Everett Olds, Twin State Gas & Electric Company, Boston. The first meeting of the committee was held last week, and it was brought out that not more than ten companies in New England are at present selling their securities to their customers. Besides planning to promote the idea of customer ownership the committee is prepared to assist companies wishing to take up this method of marketing their securities and will collect full information about various successful campaigns, with exhibits of advertising used, forms, plans, sales manuals, etc.

New Power Business Expanding in Baltimore

NEW power business is expanding in Baltimore. Reports from the power sales department of the Consolidated Gas, Electric Light & Power Company of that city for March show added load from sixty-two customers, these customers representing thirty-six kinds of industries. This added load amounted to 1,403.3 hp. of power load and 352.8 kw. lighting. The total business for the month showed an increase over February.

N. E. L. A. Chicago Convention Program

DETAILS of the tentative program of the convention of the National Electric Light Association to be held at the Drake Hotel, Chicago, May 31, June 1, 2 and 3, have been announced as printed on the opposite page. In number of papers and reports the program is somewhat shorter than last year's.

Local committees in Chicago are working on the entertainment programs, details of which are expected to be announced shortly.

The association has again decided not to hold an exhibition, as was customary prior to the war. The only exhibits planned so far are one by the Lighting Sales Bureau on domestic lighting, following along lines somewhat similar to the now well-known industrial lighting demonstration, and the Electric Vehicle Show in the showrooms of the Commonwealth Edison Company and under its auspices.

April Financing Unusually High

THE April bond and note issues of electric light and power companies amount to $34,824,000 and bear an average yield of 7.78. This comparatively high total not only exceeds the total for April of last year by more than $2,000,000, but also denotes an increase of 35 per cent over last month's total. Long terms and high yields are again the chief characteristics of the issues. Of the thirteen companies represented below, nine offer securities to mature in not less than ten years. The sum of these issues alone almost equals the entire March offering. The 9 per cent yield on the $1,000,000 issue of the Standard Gas & Electric Company is exceptionally high. The average yield for the month was 7.78 per cent. The most important offering of the month is the $13,734,000 issue of the Puget Sound Light & Power Company, the largest in over a year in this field.

Name of Company	Amount of Issue	Period	Class of Security	Purpose of Issue	Rate of Int.	Per Cent Yield	Offered at
Puget Sound Power & Light Co.	$13,734,000	20-year	General and refunding mortgage gold bonds, series "A"	Retirement of sinking fund gold notes	7.5	7.75	97.5
Northern States Power Co.	1,000,000	20-year	First and refunding mortgage gold bonds	Refunding	6	7.10	88.5
Standard Gas & Electric Co.	1,000,000	20-year	Gold notes of 1915		6	9	76
Southern Indiana Gas & Electric Co.	1,000,000	20-year	First lien and refunding mortgage gold bonds, series "A"	Refunding	7.5	8.10	94
Detroit Edison Co.	2,750,000	25-year	First and refunding mortgage gold bonds, series "B" of 1915	Refunding	6	7.10	88.5
Twin State Gas & Electric Co.	1,000,000	10-year	Bond-secured gold notes	Refunding and new construction	8	8.37	97.5
Hagerstown & Frederick Ry.	1,600,000	30-year	First and refunding sinking-fund gold bonds of 1914	New construction	6	7.5	83.5
Hagerstown & Frederick Ry.	540,000	8-mos.	Convertible collateral trust coupon notes, series "A"		8	8	Par
Portland Ry., Light & Power Co.	1,000,000	5-year	Gold notes		8	8	Par
Northern Virginia Power Co.	1,200,000	.....	General mortgage gold bonds, series "A"	Retirement of outstanding notes and floating debt	7	7.5	96.5
Laurentide Power Co., Ltd.	1,500,000	15-year	General mortgage bonds	New construction	7	7.5	95.54
Penn Public Service Corp.	1,500,000	15-year	First and refunding mortgage gold bonds, series "B"	Refunding	7.5	8	95.75
Philadelphia Electric Co.	5,000,000	.....	Cumulative preferred stock		8	....	Par
Monongahela Valley Traction Co.	2,000,000	1-year	Sinking-fund gold note	Retirement of outstanding notes	8	8	Par
Total	$34,824,000						

N. E. L. A. Chicago Convention Program

(Tentative Draft Subject to Revision)

General and Executive Sessions

TUESDAY, MAY 31, 9:30 A. M.

1—Welome to Chicago (speaker to be selected).
2—Address of President Insull.
3—Appointment of committee on president's address.
4—Report of Treasurer Abell.
5—Report of Executive Manager Aylesworth.
6—Address of chairman Accounting Section, J. C. Van Duyne.
7—Address of chairman Commercial Section, M. S. Seelman, Jr.
8—Address of chairman Public Relations Section, J. E. Davidson.
9—Address of chairman Technical Section, I. E. Moultrop.
10—Report of committee on constitution and bylaws, W. C. L. Eglin.
11—Report of committee on constitutional revision.
12—Announcements.
13—Report of committee on membership, Walter Neumuller.

WEDNESDAY, JUNE 1, 9:30 A. M.

1—Report of committee on company employees' organizations, David Darlington.
2—Report of committee on rate research, Alex Dow.
3—Report of committee on constitutional revision.
4—Vote on constitutional amendments proposed.
5—Election of nominating committee.
6—Address, "Power," Samuel Insull.
7—Appointment of committee on memorials.
8—Appointment of committee on resolutions.
9—Address (subject to be selected), James A. Perry, president National Association of Railway and Utility Commissioners.
10—Report of public policy sub-committee on inductive interference, R. H. Ballard.
11—Announcements.
12—Report on "Superpower Survey," Charles L. Edgar.
13—Report of lamp committee, Frank W. Smith.
14—Report of wiring committee, R. S. Hale.

THURSDAY, JUNE 2, 9:30 A. M.

1—Report of insurance committee, S. E. Wolff.
2—Report of committee on electrical resources of the nation, M. S. Sloan.
3—Report of committee on water-power development, Franklin T. Griffith.
4—Address (subject and speaker to be selected).
5—Announcements.
6—Address, "The Electric Vehicle," Arthur Williams.
7—Address (subject and speaker to be selected).
8—Report of committee on co-operation with other associations, Sidney Z. Mitchell.
9—Report of committee on accident prevention, Charles B. Scott.

FRIDAY, JUNE 3, 9:30 A. M.

1—Report of committee on Doherty and Billings Prizes, A. S. Loizeaux.
2—Report of exhibition committee, C. L. Peirce, Jr.
3—Report of committee on electrification of steam railroads, Louis A. Ferguson.
4—Address, "Customer Ownership," John F. Gilchrist.
5—Address (subject and speaker to be selected).
6—Report of committee on president's address.
7—Report of committee on memorials.
8—Report of resolutions committee.
9—Report of nominating committee.
10—Election and installation of officers.

Technical Sessions

TUESDAY, MAY 31, 2:15 P. M.

1—Address of chairman, I. E. Moultrop.
2—Appointment of nominating committee.
3—Report of committee on electrical apparatus, R. F. Schuchardt.
4—Report of committee on safety rules, Thomas Sproule.

PARALLEL SESSION

Report of meter committee, W. L. Wadsworth.

WEDNESDAY, JUNE 1, 2:15 P. M.

1—Election of officers.
2—Report of committee on overhead systems, W. K. Vanderpoel.
3—Report of committee on inductive interference, A. E. Silver.

THURSDAY, JUNE 2, 2:30 P. M.

1—Report of committee on hydraulic power, Markham Cheever.
2—Report of committee on prime movers, N. A. Carle.

PARALLEL SESSION

Report of committee on underground systems, F. E. Ricketts.

Public Relations Sessions

WEDNESDAY, JUNE 1, 2:30 P. M.

1—Address of chairman, J. E. Davidson.
2—Appointment of nominating committee.
3—Report of committee on manufacturers' advertising, P. L. Thomson.
4—Report of committee on public utility information, John F. Gilchrist.
5—Report of committee on public utility taxation and uniformity of regulatory laws, W. W. Freeman.
6—Report of committee on relations with bankers, M. S. Sloan.
7—Report of committee on relations with regulatory bodies, R. H. Ballard.
8—Report of committee on upbuilding the industry, F. R. Coates.
9—Election of officers.

THURSDAY, JUNE 2, 8:30 P. M.
(With music)

1—Report of public policy committee, Sidney Z. Mitchell.
2—Address (speaker of national prominence invited).

Accounting Sessions

TUESDAY, MAY 31, 2:15 P. M.

1—Address of section chairman, J. C. Van Duyne.
2—Appointment of nominating committee.
3—Report of committee on accounting education, Fred R. Jenkins.
4—Report of committee on classification of accounts, reports to commissions and relations with other associations, W. J. Meyers.
5—Report of committee on purchasing and storeroom accounting, W. F. Stevens.

WEDNESDAY, JUNE 1, 2:15 P. M.

1—Report of committee on federal income-tax procedure, F. B. Odlum.
2—Paper, "Accounting for Coal," H. M. Edwards.
3—Report of committee on customers' records and billing methods, J. D. Jacobus.
4—Report of committee on credits and collections, David Darlington.

THURSDAY, JUNE 2, 2:15 P. M.

1—Election of officers.
2—Report of committee on bonus systems A. H. S. Cantlin.
3—Report of committee on security holders' records, William S. Kline.
4—Report of committee on investment budget control, Harry A. Snow.
5—Address, "Accounting Service to Member Companies," E. J. Fowler.

Commercial Sessions

TUESDAY, MAY 31, 2:15 P. M.

1—Address of section chairman, M. S. Seelman, Jr.
2—Appointment of nominating committee.
3—Report of Bureau of Advertising and Publicity Service, L. D. Gibb.
4—Report of division on adequate outlets and co-ordinate advertising P. L. Thomson.
5—Report of division of illuminating engineering, non-technical, P. B. Zimmerman.
6—Report of division on motion-picture films, M. C. Turpin.
7—Report of division on national commodity advertisers, Earl E. Whitehorne.
8—Report of division on newspaper advertising campaigns, Norman Maul.
9—Report of division on news syndicate and magazine writers, Frank B. Rae, Jr.
10—Report of division on publications, Cyril Nast.
11—Report of committee on education, Fred R. Jenkins.
12—Report of committee on "Electrical Salesman's Handbook," George H. Stickney.

PARALLEL SESSION

1—Report of Power Sales Bureau, H. H. Holding.
2—Report of division on economics of the use of central-station electric power, J. W. Meyer.
3—Report of division on industrial electric heating, N. T. Wilcox.
4—Report of division on electric arc steel furnaces, Joseph McKinley.
5—Report of division on general power, George H. Jones.
6—Address on "The Power of Transportation," E. S. Mansfield.

WEDNESDAY, JUNE 1, 2 P. M.

1—Report of Merchandise Sales Bureau, Dorsey R. Smith.
2—Report of division on electrical merchandise, C. E. Greenwood.
3—Report of division on electric shop management, Thomas Berger.
4—Report of division on standardizing and testing, R. S. Hale.
5—Report of electric range division, C. O. Dunten.

PARALLEL SESSION

1—Report of Electric Vehicle Bureau, E. S. Mansfield.
2—Reports of several committees (details to be supplied).
3—Paper, "Economy of Electric Vehicles," (speaker to be selected).
4—Paper, "Electric Vehicle Problems," (speaker to be selected).
5—Discussion.
6—Report of committee on compensation of salesmen, L. R. Wallis.
7—Address, "Capitalizing an Opportunity," William L. Goodwin.
8—Report of committee on commercial service and relations with customers, L. A. Coleman.

THURSDAY, JUNE 2, 2:15 P. M.

1—Report of nominating committee.
2—Election of officers and executive committee.
3—Report of Lighting Sales Bureau, Oliver R. Hogue.
4—Report of committee on educational exhibits, Clarence L. Law.
5—Report of division on residence lighting, M. Luckiesh.
6—Report of division on street and highway lighting, W. D'A. Ryan.
7—Report of division on industrial lighting, C. Bertram Regar.
8—Report of division on lighting of large buildings, F. A. Gallagher.
9—Report of division on commercial aspects of lamp equipment, Earl A. Anderson.
10—Report of division on sign, display and billboard lighting, H. I. Markham.
11—Report of division on store lighting, James J. Kirk.

To Consider Symbols for Electrical Equipment in Buildings

FOR the purpose of adopting a program looking toward the establishment of national symbols for electrical equipment in buildings the American Engineering Standards Committee has at the joint request of the National Association of Electrical Contractors and Dealers and the American Institute of Architects, called a conference of representatives of all interested national associations for May 10 at the Engineering Societies Building, New York.

Among the standards recently approved by the American Engineering Standards Committee are the standard method for sampling of coal submitted by the American Society for Testing Materials and the National Electrical Code.

Service Charge Legislation Rejected in Connecticut

THE Connecticut Legislature has rejected the proposed anti-service-charge legislation which received considerable attention early in the present session. In its place an act has been drafted which would authorize the Public Utilities Commission to regulate all rates and charges upon petition of companies, municipalities or any ten patrons of a public utility. Service charges by gas companies have been chiefly attacked.

Governor Lake has signed the bill authorizing the Hartford Electric Light Company to increase its capital stock to $20,000,000, issued at not less than par.

The bill authorizing to transmit and sell electricity for manufacturing uses under the jurisdiction of the Public Utilities Commission any corporation allowed to construct and maintain dams, to own and operate mills and to utilize its generated power in such operation has passed both branches. Such distribution and sale, however, are not permitted in territory already covered by municipal or private franchise.

Southwestern Division, N. E. L. A., Will Discuss Many Topics

AN EXTENSIVE program has been arranged for the annual convention of the Southwestern Geographic Division of the National Electric Light Association, which is to be held at Hot Springs, Ark., May 13 and 14. The program includes papers and addresses on the following subjects: "Customer Ownership," by C. J. Stubner of Henry L. Doherty & Company; three papers, on "Security Holders Records," "A Uniform System of Accounting" and "The Bonus System" respectively, to be read at the afternoon session on May 13; an address by W. E. Clement, New Orleans Railway & Light Company; "Merchandise Sales," by W. B. McSpadden of the City Light & Water Company of Amarillo, Tex.; "Commercial Service and Relations with Customers," by P. C. Tucker; "Lighting Sales," by C. S. Barber; "Power Sales," by R. I. Brown; "Advertising and Publicity Service," by J. C. Lamb; "Electric Vehicles" and an illustrated lecture on "Correct Industrial Lighting," both by F. J. Schwab; "Publicity," by H. A. Lane, secretary of the division; "Should the Public Utility Company Advertise?" by G. A. Davis; an address by J. B. Thomas, chairman of the Technical Section; "The Application of Diesel Engines to Small Electric Power Stations," "Valuation for Rate Making," "The Economies of Transmission-Line and Distributing System Supports," and "The Operating Problems of Inductive Interference," all four of these papers to be read before the Technical Section on May 13.

On the evening of May 13 the annual banquet of the division will be held. The members will hear a talk by Martin J. Insull, president of the N. E. L. A., on "The Public's Business," following a talk by A. Hardgrave, president of the division. On Saturday morning, May 14, there will be a general session at which the following addresses will be given: "Public Policy," by Hamilton Moses; "The Kansas Industrial Law," by W. L. Higgins of the Court of Industrial Relations of Kansas, and "The Superpower Central Station," by J. B. Thomas of the Texas Power & Light Company. The report of the wiring committee will be presented at this meeting also. At the general session of Saturday afternoon will be presented papers on "Needs of the Industry," by J. H. Gill; "Work of the N. E. L. A.," by W. J. Canada, and "Internal Organization," by J. F. Owens.

English Publisher of Industrial Periodicals Here to Study Labor

ERNEST J. P. BENN, managing director of Benn Brothers, Ltd., of London, the foremost publishing house of engineering and trade papers in Europe, arrived in the United States a few days ago to study industrial conditions and confer with officials of the National Civic Federation. Mr. Benn has been engaged in publishing for forty-odd years, and among his twelve publications are the *Electrician* and the "Electrical Trades Directory," both extremely well known in the United States.

At the present time he is especially interested in labor conditions and is considered one of the foremost authorities on that subject in England. His trip to the United States primarily is to obtain as much information as he can regarding the labor situation.

On Thursday noon representative business-paper publishers gave a luncheon at the Engineers' Club in honor of Mr. Benn, at which James H. McGraw, president of McGraw-Hill Company, Inc., was invited to preside as toastmaster. At this time the representatives of American engineering papers who made the trip to Europe at the close of the war took occasion once more to express to Mr. Benn their lasting appreciation of the many courtesies which he showed them at that time.

Southwestern Men Have Full Program for Galveston Meeting

MARTIN INSULL, president of the National Electric Light Association, will on May 19 address the seventeenth annual convention of the Southwestern Electrical and Gas Association at Galveston, Tex., on "The Public's Business"; J. H. Gill will discuss "The Utility Association as a Permanently Profitable Investment," and Dr. E. P. Schoch will speak on "The Latest Development in Texas Lignite." On May 20 W. G. Busby, chairman Missouri Public Service Commission, will speak on "State Utility Commissions," W. J. Canada of the N.E.L.A. on "Inductive Interference," and there will be two addresses on "Home-Town Financing of Local Utilities" by men who have had practical experience along this line and an address on the same topic from the banker's point of view by a Texas banker.

The convention will open on Wednesday afternoon, May 18, when the president's address and an address by an invited speaker will be made.

Need for Uniformity in Contractors' Licensing Risk Seen

LACK of similarity in legislation relative to licensing electrical contractors is receiving attention from the New York State Association of Electrical Contractors and Dealers. The subject of licensing is now up in a number of different cities in the state, no two of which are considering similar arrangements. The association states that it fears that if this matter is handled in such a miscellaneous way it will result in a "welter of rules and regulations that will be contradictory and obviously embarrassing to contractors in attempting to execute work in different localities."

The New York State association suggests the serious consideration of this subject by members of the national association and district associations.

All Branches of the Industry Co-operate in Illumination Exhibit

AN EXHIBIT designed to display the most modern equipment available for industrial, commercial and residential lighting will be opened in the Rogers Building, Massachusetts Institute of Technology, Boston, in the latter part of May under the auspices of the Institute, the central-station, jobbing, manufacturing and contractor-dealer interests of the city. It is hoped that the exhibit can be maintained for at least five years as a center of advanced lighting instruction and demonstration. The "Bureau for Better Illumination" has been organized to handle the work, and the following committees have been appointed: Engineering, Prof. W. J. Drisko (chairman), J. Daniels, R. R. Ringer; publicity, L. D. Gibbs (chairman), M. R. Griffeth, C. M. Stow, E. H. Whitney; finance, V. M. F. Tallman (chairman), J. E. Wilson, C. B. Burleigh, W. F. Abely; general, H. F. Wallace (chairman), A. W. Ives, J. E. Wilson (secretary), W. J. Drisko, W. H. Atkins, W. F. Abely, F. S. Price, C. S. Davis, J. Daniels, H. T. Sands, William Gould. A maintenance committee has been suggested to care for the exhibit.

Cincinnati Company Installs More Generating Capacity

IN THE report just issued to stockholders of the Cincinnati Gas & Electric Company, Charles D. Jones, president of the company, shows that the total assets at the close of 1920 were listed at $53,050,478.82. The report also reviews the various features, physical and financial, of the company. In view of the present condition of the bond market the issuing of any bonds under the new $50,000,000 authorized mortgage has been deemed unwise.

A fourth unit of 30,000-kw. capacity is now being installed in the company's plant and is expected to be in readiness for operation some time during the coming summer. This will bring the total generating capacity of the plant to 120,000 kw. and the company then will be in a position adequately to handle the rapidly increasing demand for power.

The approved capital charges for the year 1920 other than power house expenditures amounted to $1,000,749, an increase of $465,907 over 1919. This large increase, it is pointed out in the report, is due mainly to the tremendous increase in the demand for electric service. The budget of estimated expenditures for this year is figured at $559,000, of which $82,000 is for the gas department and $447,000 for the electric department.

Seasonal Freight Rates on Lake Coal

THE Interstate Commerce Commission by authorizing the carriers to put in effect reduced rates on lake coal has authorized what is in effect a seasonal coal rate. The decision is regarded as being one of the most significant since the priority orders of last fall.

The authorization took the form of a special permission. Such permissions, No. 52,757 and No. 52,761, dated April 27, authorized the carriers participating in the movement of coal to Lake Erie ports for trans-shipment by water to reduce rates for such transportation 28 cents per net ton until Oct. 31, 1921.

This order is expected to stimulate the shipment of coal to lower lake ports. The adjustment of the rates from the upper lake ports to interior points still is under discussion.

A. I. E. E. Standards Committee Meets May 19

THE standards committee of the American Institute of Electrical Engineers will hold a meeting on May 9 at the headquarters of the Institute in New York, at which time it is expected that the latest edition of the standardization rules will be off the press. Prof. D. C. Jackson, Massachusetts Institute of Technology, Cambridge, Mass., is chairman.

A. I. E. E. Now Has 12,201 Members

THE year-book of the American Institute of Electrical Engineers for 1921, which has just been published, shows an increase in membership from Jan. 1, 1920, to Jan. 1, 1921, of 1,509. The present membership of all grades is 12,201, distributed as follows:

	Jan. 1, 1920	Jan. 1, 1921
United States	9,770	10,447
Canada	525	624
Newfoundland	2	2
Mexico	37	42
Central America	60	59
West Indies	34	51
South America	109	124
South Africa	20	24
Asia	226	280
Australia	127	149
Europe	346	399
Total	10,692	12,201
Honorary members	6	6
Fellows	494	528
Members	1,541	1,799
Associates	8,651	9,868

This increase in membership makes the slope of the curve of membership for the period 1916 to 1921 considerably steeper than for the period 1900 to 1910, just prior to the regrading of the membership and the establishing of the grade of fellow in 1912. Between 1900 and 1910 the increase was at the average rate of 575, and from 1910 to 1916 it was at the rate of 233 per year. Since that time the average rate has been 950 per year. Eighty per cent of the increase of the past year was in the associate grade, with new members drawn mostly from the engineering and sales departments of the large electrical manufacturing companies and from the operating departments of public utilities and industrial plants.

Colorado River Commission Now Gathering Data

THE recently formed Colorado River Commission is now gathering data to be used as a basis for recommendation as to the development of the river. This commission consists of the state engineers and officers having jurisdiction over irrigation and water rights, together with officers of the Reclamation Service. It was formed through the efforts of the League of the Southwest, in which are joined as official members the Governors of California, Nevada, Arizona, New Mexico, Utah, Colorado and Wyoming. In addition to the engineering commission a treaty commission is being formed to formulate laws and prosecute treaties between the several states. These treaties will require approval by Congress.

Up to the first of the year filings for power developments on the Colorado River and its tributaries exceeded 4,000,000 hp. Principal among these is the application of the Southern California Edison Company for development of three sites totaling 3,570,000 hp.

Under the Kincaid act, which authorized the Reclamation Service to investigate the problems of the Imperial Valley, a report has been rendered covering the studies completed to date of Nov. 6, 1920. Since that date the investigations have been continued, including work at the Boulder Canyon dam between California and Arizona, where it is proposed to construct a 25,000,000-acre-ft. storage and flood-control reservoir.

All available data will be given to F. E. Weymouth, chief engineer of the Reclamation Service, Denver, who is secretary of the Colorado River Commission, for compilation. A. J. McCune, Colorado state engineer, is chairman of the commission.

Efficiency in Business to Help Meet Demand for Lower Prices

MORE work from fewer men, greater efficiency in advertising and a careful study of costs and credits—these are the tools used by American business to effect lower costs in order to meet the demand for reduced prices, according to the findings derived from a survey just completed by the department of domestic distribution of the Chamber of Commerce of the United States. Answers were received from about 2,000 business men, retailers, wholesalers and manufacturers. The questions had to do only with distribution costs, and all answers which deal solely with production problems were omitted.

The replies for the most part report what has been done, but a final question asked for suggestions as to how the domestic distribution department might help in lowering the cost of merchandising to a normal basis. By far the largest number of answers said, "Do something to lower freight rates."

The greatest variety of answers was received in response to the question, "What are you doing to reduce your personnel costs to a normal basis?" The general tone of these answers pointed not so much toward a reduction in wages as to a reduction of the number employed. Only about one-fourth of those who answered had made any direct reduction of wages. About 58 per cent have reduced the number of employees and have done away with one-fifth of their workers. One-fifth reported that they had done away with or reduced commissions and bonuses.

More than one-fourth of those answering said they had cut down advertising space. This was in part balanced, however, by reports from many others who found depression a justification for an increased use of space. Frequently through the comment which accompanied the answers to the questions about publicity there appeared a note of determination not to cut off this method of selling but to make certain of greater results.

Surprisingly little was done by the 2,000 business men in the cutting down of service to customers.

More than 20 per cent of those who answered had made a reduction in volume of credit business. Some had shortened the time on charge accounts, while a considerable number—more than 4 per cent of the whole—had lengthened time on this class of business.

A general question as to what other means had been used to reduce costs drew forth a wide variety of replies. Stopping the little leaks has engaged as much of the business men's attention as reducing the heavier expenses. Budgets are getting much more careful attention.

Arc-Welding Applications Increase 100 per Cent in 1920

ELECTRIC arc welding has had a very rapid growth during the past few years both in sale of apparatus and in increasing scope of application, according to data presented by the electric arc welding committee before the recent annual convention of the American Welding Society at New York on April 27, 28, 29 and 30. The number of sales of equipment for 1920 was double that for 1919, and at the same time the increased sale of electrode material shows that the field of application has also more than doubled. It was the consensus of opinion that the field for electric welding was so large that no unnecessary attempts should be made to compete in work that logically belongs to the field of gas or thermit welding.

Carbon arc welding has shown better results for welding $\frac{1}{16}$-in. or $\frac{3}{32}$-in. steel plates than metallic electrode welding, asserted R. F. Wagner of the General Electric Company in his discussion before the electric arc welding committee. Less skill is required of the operator in manipulating the tapered carbon pencil electrode used for this work than in handling the metallic electrode. Greater speed is also obtained. Both direct current and alternating current are used for the welding on thin plates, although smoother work is done with direct current. Other important subjects considered by this committee were cast-iron welding, locked-up stresses and standard tests for welds.

The committee on training of operators, William Spraragen, chairman, decided to get in touch with various welding schools in order to find out the methods of handling courses of study and training for operators. An attempt will also be made to work up a series of standard tests that may be given to operators to determine their fitness for handling welding work.

Standardization of apparatus ratings for the benefit of the manufacturer, user and central station will be attempted by the resistance welding committee, Herman Lemp chairman. Nomenclature standardization will also be taken up.

New officers elected for the American Welding Society were: President, S. W. Miller, Rochester Welding Works, and vice-president, C. A. McCune, Paige Steel & Wire Company. The American Bureau of Welding,

which is a joint advisory board of the American Welding Society and the Engineering Division of the National Research Council, retains its former officers, Comfort A. Adams, director, and William Spraragen, secretary.

Mechanical Engineers Will Discuss Power Problems at Spring Meeting

WELL-DEVELOPED programs will be carried out by the different divisions of the American Society of Mechanical Engineers, which will hold its spring meeting at the Congress Hotel, Chicago, on May 23-26. The Power Division is co-operating with the Chicago Section of the A. I. E. E. and the mechanical and electrical sections of the Western Society of Engineers to provide papers on the power resources of the Middle West. The power session will be presided over by Samuel Insull, president of the Commonwealth Edison Company. The situation regarding power development and interconnection of power systems will be reviewed by W. L. Abbott, Commonwealth Edison Company, and there will be a paper by C. W. Place of the General Electric Company, describing the water-power resources of that section. The first three power test codes developed by the A. S. M. E. will be presented for public hearing. These are on general instructions, reciprocating steam engines and evaporative apparatus.

Other features of the meeting will be a paper on the hydraucone regainer by William M. White, manager and chief engineer of the hydraulic department of the Allis-Chalmers Manufacturing Company, which will outline the development of this device and its successful application in hydro-electric projects, leading to high water-wheel efficiency, and more economical power-house construction; a paper on boiler-water analyses by J. R. McDermet, research engineer of the Elliott Company, and a paper by H. B. Reynolds of the Interborough Rapid Transit Company presenting the results of a series of tests on a 30,000-kw. steam turbine.

Power-Load Figures Reflect Industrial Conditions in Ohio

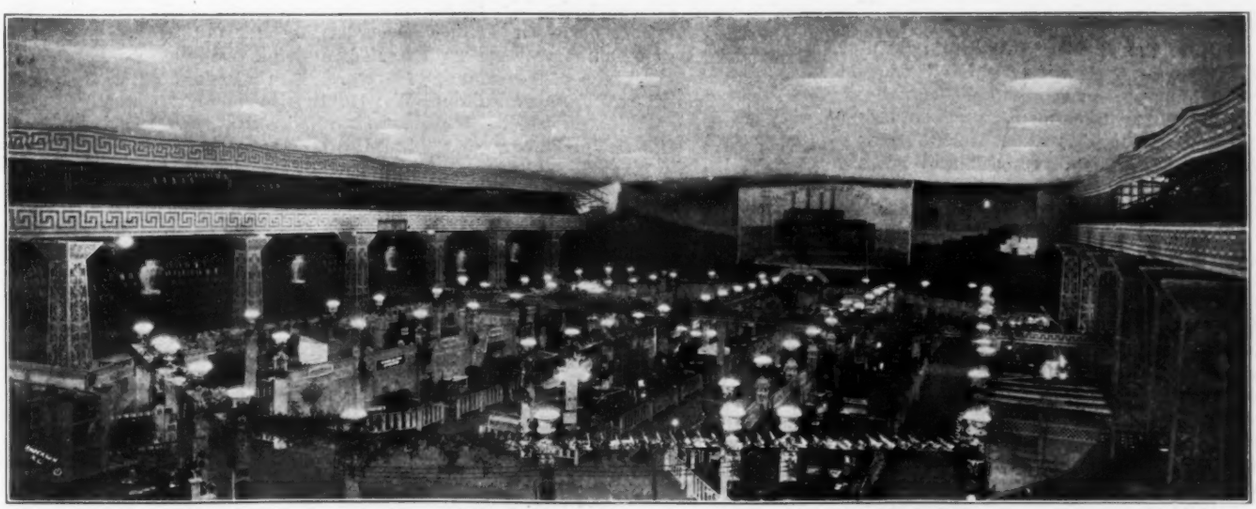
INDUSTRIAL conditions throughout Ohio are reflected by statistics compiled by the Ohio Committee on Public Utility Information showing the quantity of electricity generated for light and power by large central-station plants during March, as compared with the same month last year. The figures indicate a falling off of around 23 per cent in the production of electricity as compared with March, 1920. In that month 150,704,416 kw.-hr. was generated by central-station plants in eleven of the largest cities of Ohio, while in March of this year the amount generated was 115,887,465 kw.-hr., a decrease of 34,816,951 kw.-hr.

This large decrease is due to the fact that industrial plants are not using nearly so much electricity as they were last year. More electricity is being used in homes, however, according to central-station operators, one large central-station company adding domestic consumers at the rate of 2,000 a month.

Program for National District Heating Association Convention

A LARGE attendance is expected at the twelfth annual convention of the National District Heating Association, which is to be held at the Breakers Hotel, Cedar Point, Ohio, June 22, 23 and 24. The tentative program of the convention includes papers and discussions on "Insurance Rates as Affected by District Heating Installations," "Does Installation of Electric Generators in Connection with Steam Heating Pay?" "Experience with Non-condensing Turbines in Industrial Heating Work," "Use of Pulverized Coal," "Hot Water Rates," "Customers' Installations" and "Advantages of Central-Station Heat from the Viewpoint of the Building Manager." There will also be a symposium on the mechanical stokers and their performances and an address on the coal situation.

Southwest Unites in Electrical Show



ONE hundred and fifteen exhibitors participated in the first Kansas City electrical show, which closed April 23. There were around 75,000 paid admissions. While the show was conducted co-operatively by the Kansas City electrical interests, it served in a measure to unite the electrical industry of the Southwest. A number of the associations of that section arranged to meet in Kansas City during electrical show week. One of the features of the show was the general illumination, the general scheme of which can be seen in the illustration. Eighty 1,000-watt "tip-up burning" lamps were used in inverted bowl reflectors. An intensity of 16-foot candles on the lighting plane was secured.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest

Pennsylvania Company's Rights in Ellwood City Sustained. — The Public Service Commission of Pennsylvania has ordered the Harmony Electric Company to "desist from constructing a distribution line or any additional facilities for the purpose of supplying electrical energy to consumers in the borough of Ellwood City." This action was taken on the complaint of the Pennsylvania Power Company, between which and the Harmony company a dispute over rights in the territory concerned existed. The commission had previously refused approval of a contract between the Harmony company and the borough.

War Department Will Train Amateur Radio Operators.—The United States War Department, through the Chief Signal Officer of the army, is making arrangements for the training of amateur radio operators and devising plans for utilizing their services should a national emergency arise. There are nine army corps areas, and in each of these it is intended that an organization of amateurs shall be formed. At the respective corps headquarters there will be established a transmitting radio station with a range sufficient to cover the entire corps area. Courses of instruction will be prepared and sent out by radio and by mail. The amateur personnel will be formally inducted into the Signal Reserve Corps and will where practicable be called to active camp service for two weeks in the summer.

Pacific Gas & Electric Company Enters Into Contract with Red River Lumber Company.—An important contract has been drawn between the Pacific Gas & Electric Company and the Red River Lumber Company, which has large timber holdings in the Pit River country, where the Pacific Gas & Electric Company is engaged in a large construction program. By virtue of its large holdings the Red River Lumber Company held large riparian rights on Pit River, Fall River and Hat Creek and had intended to develop power on these streams for the purpose of making paper pulp. In exchange for all of its water rights and clear title to a strip of land 25 ft. wide on each bank of these streams above high-water mark, the use of roads, trails and camp sites and rights-of-way for pole and tower lines, and the right of rental of certain of the Red River Lumber Company's stock and equipment, the Pacific Gas & Electric Company had given the Red River company an option on Hat Creek Power House No. 1 and Hat Creek Power House No. 2. When and if it takes over Power House No. 1 the Red River company will pay for the actual cost of the plant minus a certain consideration. When and if it takes over the second power house it will pay the Pacific company the actual cost of the plant. Until the time that these plants are taken over by the Red River company they will be operated by the Pacific company. The contract has been submitted to the California Railroad Commission.

Rural Electrification in Finland.—A report from the American Consul at Helsingfors, Finland, says that thirty-one rural districts in that country out of sixty-four having 25 per cent of their total area under cultivation are supplied with electricity and that service is also being given to some districts with a poorer percentage of cultivated land. There are three large electric plants in the agricultural sections, of which one has just been built to take advantage of a water-power source in the Province of Abo. This plant produces low-tension energy for use in its immediate neighborhood and also transits power at 20,000 volts for a distance of 26 miles, this energy being stepped down for lighting and motor service to farms within the area supplied.

Electricity in British Columbia Coal Mines.—The only smelter in the world refining five different metals—gold, silver, lead, copper and zinc—is, according to E. A. Haggen, a Britihh Columbia mining authority, to be found at Trail, in that province. This development, as well as that of the Rossland mines, had come through the exploitation of hydro-electric power at Bonnington Falls on the Kootenay River. The West Kootenay Light & Power Company, which operates the Bonnington Falls plants, is extending its lines westward to Princeton, 180 miles from the plants, and eastward to the Sullivan mine in East Kootenay, more than 100 miles. Transmission on the westerly line is to be at 110,000 volts. Mr. Haggen expresses the conviction that if up-to-date electrical machinery were installed in the coal mines of Vancouver Island, at a cost of two or three million dollars, the price of coal would be $3 a ton less in the city of Vancouver.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

O. E. L. A. Committee Meetings.—Two meetings of the station operating committee of the Ohio Electric Light Association are scheduled for next week—one on Wednesday at Toledo, and the other on Thursday at Detroit.

A. I. and S. E. E., Pittsburgh Section.—At the meeting of this section on Saturday, May 14, to be held at the Hotel Chatham, Pittsburgh, Frederick J. Crolius, Carnegie Steel Company, Munhall, Pa., will present a paper on "Powdered Coal and Its Application to Boilers."

Connecticut Section, A. I. E. E., Organized.—The thirty-second local section of the A. I. E. E., to be known as the Connecticut Section, which was formally organized at New Haven on April 22, will include all of Connecticut with the possible exception of the three corners of the state within the technical radius of the New York, Pittsfield and Providence Sections respectively. About forty-five electrical engineers were present at the organization meeting. Dr. William McClellan, nominee for president of the parent body, addressed the gathering, pleading for the development of an engineering atmosphere in the new section as well as the discussion of engineering problems. Officers elected were: Chairman, C. F. Scott, professor of electrical engineering Yale University; secretary and treasurer, A. E. Knowlton, electrical engineer of the Public Utility Commission of Connecticut and instructor in electrical engineering at Yale; executive committee, Samuel Ferguson of Hartford, E. C. Bryant of Bridgeport, W. H. Bristol of Waterbury, E. H. Everit of New Haven, G. B. Leland of Stamford.

Coming Meetings of Electrical and Other Technical Societies

A. I. and S. E. E. Section Meetings—Philadelphia, May 7; Cleveland, May 9; Pittsburgh, May 14.

American Association of Engineers — Buffalo, May 9-11.

Society for Electrical Development Annual Meeting—New York, May 10.

Arkansas Utilities Association—Hot Springs, Ark., May 11-12. (For program see issue of April 30, page 1014.)

N. E. L. A., Southwestern Geographic Division—Hot Springs, Ark., May 13-14.

American Washing Machine Manufacturers' Association—Chicago, May 18-19.

Southwestern Electrical and Gas Association—Galveston, Tex., May 18-21.

National Electric Credit Association—Richmond, Va., May 19-20.

A. I. E. E. Annual Meeting—New York, May 20.

American Society of Mechanical Engineers —Chicago, May 23-26.

Electrical Supply Jobbers' Association—Hot Springs, Va., May 25-27.

N. E. L. A. Annual Convention—Chicago, May 31-June 3.

N. E. L. A., Pacific Coast Division—Del Monte, Cal., June 7-9. (For program see issue of Jan. 29, page 278.)

N. E. L. A., North Central Division — Duluth, Minn., June 14-16.

National Fire Protection Association—San Francisco, June 14-16.

Tri-State Water and Light Association — Asheville, N. C., June 15-16.

Canadian Electrical Association — Quebec, June 15-17.

California State Association of Electrical Contractors and Dealers—Santa Cruz, June 16-18.

A. I. E. E. Annual Convention—Salt Lake City, June 20-25. (For program see issue of April 30, page 1009.)

National District Heating Association — Cedar Point, Ohio, June 22-24.

Association of Municipal Electrical Utilities of Ontario—Niagara Falls, Ontario, June 23-25.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities

Cost of Financing Extensions.—The Pennsylvania Public Service Commission has condemned the practice of an electric supply company in requiring a deposit to cover the cost of making simple extensions under a provision in its rate schedule that the company reserves the right to charge the consumer the cost of connecting with the delivery of electrical energy and that a deposit may be required of the consumer at the discretion of the company, this clause being, in the commission's opinion, too general and misleading.

Cost of Waiving Rights Must Be Borne by Utility.—In establishing increased electric and gas schedules for the Western States Gas & Electric Company the California Railroad Commission, commenting on the action of the company in waiving as regards street lighting in Stockton the surcharge of 10 per cent previously authorized on all rates, said: "Obviously the proper consideration of applicant's electric revenue should be based upon established standard rates, and the diminution of its return by reason of applicant's favoritism in the instances of municipal service it supplies should not, in our opinion, be counted adversely against its regular consumers." The company's revenue was therefore estimated with the uncollected surcharge included.

Basing Rates Upon 100 per Cent Efficiency.—In making application for increased rates to the Virginia State Corporation Commission the Virginia Railway & Power Company contended that no deduction should be made from the fair value of the property, on a reproduction basis, for depreciation that has accrued through the years its various component parts have been in use, the argument being that so long as the property is well maintained and is adequately serving the public it should be regarded as having a value of 100 per cent for rate-making purposes. The commission held that this theory might be worthy of serious consideration when the value is made on the basis of original cost. The situation is entirely different when the reproduction cost theory is approached, for the reproduction cost of nearly any utility property today will be found to be greatly in excess of the original cost. The company contended that rates should be based upon 100 per cent efficiency and that this should be accomplished through rates that will take care of replacements and renewals. With this the commission agreed, but said that the subject was one that came under rate adjustments and not value, and that it would be taken care of in the usual allowance for depreciation reserve.

Steam-Heating Service Is By-product of Electric Service, Never Vice Versa.—The Public Service Commission of Oregon points out that no steam-heating business can be operated successfully as a separate and independent plant and that therefore a heating utility combined with an electric utility should not be charged the full proportion of fuel cost for heat sent to the heating system, since such a method would produce electric service at a considerable reduction over the cost of obtaining its equivalent by the most economical alternative method and the electric service would be considered a by-product of the steam-heating system. Inasmuch, the commission holds, as a heating plant cannot stand alone and must have the support of a more stable industry, the contrary is the case.

Apportionment of Expenses Between Departments.—The Tennessee Railroad and Public Utilities Commission in fixing rates for the Memphis Gas & Electric Company declined to follow the rule favored by many commissions of so adjusting rates that each department should bear its full position of the expense, and, finding that the rate for gas fixed in an agreed order between the municipal authorities of Memphis and the receivers of the company would, if the present electric rates continued in effect, be in excess of the rate required to provide for operating expenses and for a proper allowance for return, ordered that the rates for gas should be reduced, while the rates for electricity should stand as currently in effect. In handing down this decision the commission took occasion to declare its belief in the "service-at-cost" plan of rate adjustment as the fairest method.

Rewards for Efficiency.—In its recent findings in the Southern California Edison Company rate hearings the California Railroad Commission approved of the plans of the company to reward employees for increased efficiency and economies in operation and invited the submission of a more definite and specific plan. On this head the commission said: "We believe that utilities, which are largely monopolies and therefore not subject to the same active competition as most industries, have less incentive to maintain high efficiency, and we therefore welcome a sound and logical plan whereby utilities and the public may share in the savings from efficiencies and economies in operation. . . . It must be pointed out, however, that the public utilities act does not contemplate a division of increased profits due to reductions in price of labor, materials and supplies, increased earnings due to reductions in the level of economic conditions, possible reductions in the price of oil, or reduced cost of development of power resulting from conditions not under the control of the company."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and otner public utility companies

Alleged Benefit to Land from Overflow of Dam Not to Be Considered in Damage Suit.—The Supreme Court of Washington has sustained the inferior court in refusing to instruct the jury in Caldbick vs. Marysville Water & Power Company, a suit for damages from overflow of company's reservoirs, that there could be no recovery if the benefit to the land from material washed thereon, as reflected in its market value, was greater than the damage. The question whether the escape of the water was due to unprecedented rainfall was for the jury. (195 Pac. 1027.)*

Right to Use of Land for Water Flowage Not Lost by "Adverse User."—In a suit brought by M. Hemmis against the Consolidated Water Power & Paper Company for trespass because plaintiff's lands would be flooded by the raising of defendant's dam the Supreme Court of Wisconsin denied that the company, whose ownership of the water power, water flowage and dam privilege on the stream concerned was not disputed, had lost the right to flow the land because of "adverse user" for twenty years. The use of the land for pasturage for eight or ten years and thereafter for no other use than to cut wood and trees was not, the court held, inconsistent with the defendant's easement. (181 N. W. 743.)

Ordinance Requiring Free Municipal Service Void.—An ordinance adopted by the city of Milwaukee in 1890 and permitting the consolidation of certain electric companies in consideration of the consolidated company furnishing electrical energy to the city without charge has been declared void by the Supreme Court of Wisconsin, in Milwauke Electric Railway & Light Company vs. City of Milwaukee, in view of the invalidity of a prior ordinance attempting to prevent the consolidation of the companies, the contract being thus made without providing consideration for the service rendered. The contract requiring free energy was not validated by the statute providing that rates contained in contracts executed prior to April 1, 1907, shall not be held discriminatory, and the company, while operating under an indeterminate permit, was not excluded from claiming that the city's ordinance was invalid, because, having become subject to the restrictions of the indeterminate permit, the company became entitled also to the benefits that accrue with this form of contract. (181 N. W. 298.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System

Men of the Industry

Changes in Personnel—Responsibilities and Association Appointments of Men Engaged in Professional, Executive, Operating and Commercial Branches of the Industry

G. R. Milford, who was appointed manager of the Shasta (Cal.) division of the Pacific Gas & Electric Company at the time of the recent reorganization of that company's commercial departments, has had a long experience in engineering, construction and operation. He was born in Lamoille, Ill., in 1883 and, immediately after being graduated from the Bliss Electrical College in Washington, D. C., in 1902, entered the employ of the Moravia (N. Y.) Electric Railway Company, where he was engaged on preliminary work incident to the construction of the railway. In October, 1903, he left to take the position of engineer in charge of the Oriskany and Rome (N. Y.) divisions of the Utica & Mohawk Valley Electric Railway Company. After a short period Mr. Milford went to California and entered the employ of the Northern California Power Company, later the Northern California Power Company, Consolidated. His first duties were in connection with the construction of the Kilarc hydro-electric generating station. After this station was placed in operation he was in charge of the substations and distribution system until, in 1907, he was given charge of the entire Kilarc division. In 1910 he was promoted to be superintendent of power houses, in which position, in addition to superintending the operation and maintenance of the company's generating equipment, he had charge of the completion of the Coleman hydro-electric station then being built. In 1912 he became assistant to the general manager, E. V. D. Johnson, and was active in the consolidation of this company with the Sacramento Valley Power Company. In 1915 he was made division superintendent of the consolidated companies. When the Pacific Gas & Electric Company took over the properties of the Northern California Power Company, Consolidated, he was appointed to his present position. The Shasta division comprises a large area in the extreme northern end of the Sacramento valley.

G. R. MILFORD

E. I. Lewis, head of the Indiana Public Service Commission, has been named by President Harding as a member of the Interstate Commerce Commission and confirmed by the Senate.

Frank A. Wood has been appointed general superintendent of the Beverly (Mass.) Gas & Electric Company, succeeding C. R. Pritchard, who has resigned to become vice-president and general manager of the Lowell (Mass.) Gas Light Company. Charles B. Hodgson has been elected assistant treasurer of the Beverly company.

M. O. Leighton has been appointed director of the Southeastern branch of the Engineering Business Exchange, New York City, which conducts the purchase and sale of engineering and technical business properties. Mr. Leighton was for a number of years one of the principal engineers of the United States Geological Survey and for the past three years has been chairman of the national service committee of the Engineering Council. Associated with Mr. Leighton in carrying on the exchange will be A. C. Oliphant, who was also active in the work of the national service committee. The Southeastern branch of the Engineering Business Exchange has offices in the McLachlen Building, Washington, D. C.

M. O. LEIGHTON

Herman Spoehrer, secretary of the Union Electric Light & Power Company of St. Louis, has recently been elected president of the Missouri Association of Public Utilities, composed of officials of gas, water, electric light and power companies of the state. He was formerly vice-president of the association. Mr. Spoehrer was born in New York City in 1876. Upon his graduation from Cornell University in 1899 he received an appointment in the Brooklyn Navy Yard, where he remained five years. During the world's fair in 1904 he joined the ranks of the Union Electric Company, successively filling the positions of assistant in the general manager's office, purchasing agent and superintendent of construction to supervise the river wall, intakes and settling basins of the Ashley Street power plant. In 1906 he was appointed auditor of the company, later secretary and then secretary-treasurer. In October, 1920, he was relieved of his duties as treasurer because of the enlargement of his functions as secretary.

H. SPOEHRER

N. A. Lee has been appointed superintendent of the municipal electric light plant and waterworks system of the city of Luverne, Minn., succeeding Otto Pyles, resigned.

Roderic McRae, formerly chief lineman of the Pacific Power & Light Company, Yakima, Wash., has been transferred and has been appointed district manager of the company at White Salmon, Wash.

Ottomar H. Hanschel, at one time connected with the Sheboygan (Wis.) Railway & Electric Company and later superintendent of power plants for the Central Illinois Light Company, Peoria, Ill., has resigned as associate editor and consulting engineer on the staff of *Power Plant Engineering*, Chicago, to become associated with Deane S. Holt of Milwaukee in the Holt Power Equipment Company. This company, in addition to specializing in the purchase, sale and reconstruction of electric generators and motors, will hereafter engage in electrical engineering construction and maintenance work.

C. H. Shepherd, who has recently entered private practice as a consulting electrical engineer specializing in street-lighting and general power-system engineering, is well known for his work as electrical engineer in charge for the Commissioners of Lincoln Park, Chicago. While holding that position he redesigned and rebuilt the extensive electrical, water and motor transportation systems of Lincoln Park and in the course of this work developed the series-multiple transformer. He was graduated as an electrical engineer from the University of Wisconsin and was a student engineer with the Allis-Chalmers Company at Norwood, Ohio.

C. H. SHEPHERD

In 1908 he became connected with the Commonwealth Edison Company of Chicago and for two years was chief engineer of its Fisk Street station. From 1910 to 1912 he was operating engineer for the Commissioners of Lincoln Park. In 1912 he became connected with the department of electricity of the city of Chicago and was made chief layout engineer, designing and superintending the construction of a large part of the present municipal street-lighting system of the city. In 1914 he became electrical engineer in charge for the Commissioners of Lincoln Park. In 1920 he joined Dr. Edward S. Bemis, being made department engineer in charge of the valuation of the St. Paul street-railway system and the valuation of the distribution system of the Springfield (Ill.) Gas & Electric Company. From this position Mr. Shepherd resigned to enter private practice.

William J. Tideman, formerly chief engineer and factory manager of the Tideman Electric Company of Cairo, Ill., is now chief engineer in charge of production and design of the United Electric Company of Canton, Ohio, maker of "Ohio" electric cleaners. Previous to his connection with the Tideman company Mr. Tideman was a radio engineer in the United States Navy. In the early days of the war he was factory manager of the Menominee Electric Manufacturing Company of Menominee, Mich., at a time when this company was building high-tension magnetos for the British government. Prior to that he was general manager of the Dudley Tool Company of Menominee, manufacturers of ammunition.

Stephen I. Miller, dean of the department of business administration of the University of Washington, has been appointed manager of the Northwest Electrical Service League. Dean Miller will devote his entire time to the educational campaign to be undertaken by the league, retaining his connection with the university in an advisory capacity only.

Douglass Wood, formerly a district representative for the Bryan-Marsh division at Chicago, National Lamp Works of General Electric Company, has been promoted to the position of manager of the Colonial electric division, National Lamp Works of General Electric Company, at Warren, Ohio, succeeding A. E. Williams, who resigned April 1, 1921. Mr. Wood has been a member of the Bryan-Marsh division at Chicago since 1913. He enlisted in the army in April, 1917, as a private and was discharged as a major after twenty months' service overseas.

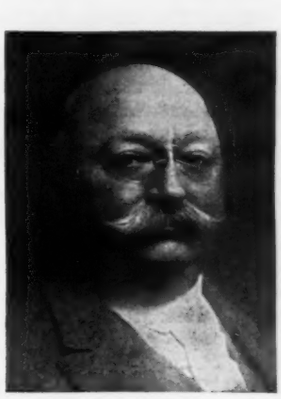
Obituary

Montgomery Clark died on April 20 at Atlantic Highlands, N. J. Mr. Clark was sales representative of the Bryan-Marsh Division of the National Lamp Works of the General Electric Company, New York City, for seventeen years. He was fifty years of age.

Z. V. Taylor, president of the Southern Public Utilities Company, Charlotte, N. C., died recently while en route from Charlotte to New York. Mr. Taylor had been identified with public utility affairs in the South for a number of years and was for a time associated with the Southern Power Company in an executive capacity. Later, when the Southern Public Utilities Company was organized by the uniting of electric light, power and railway interests in several of the largest cities in North and South Carolina, Mr. Taylor was placed in charge of the company's affairs as its president. He was born in Sparta, Tenn., in 1868 and spent his early life in the practice of law under Judge W. P. Bynum at Greensboro.

Samuel E. Tinkham, who had been associated with the engineering department of the city of Boston since 1874, died on April 21. Mr. Tinkham had been prominent in engineering affairs in New England for more than forty years, serving as secretary of the Boston Society of Civil Engineers from 1880 to 1882 and again from 1887 to the time of his death. Although a civil engineer, he was closely identified with all branches of engineering and gained a high reputation as a consulting engineer. He was graduated from the Massachusetts Institute of Technology.

Willard Layman Candee, organizer with Charles A. Cheever of the Okonite Company and its president for a number of years, suddenly died of heart failure on April 25 while riding in his motor car. Captain Candee was a well-known pioneer in electrical work. He became interested in the telephone soon after its invention and was among the first to see its commercial possibilities. In August, 1877, he became associated with Mr. Cheever and H. L. Roosevelt in the organization of the New York Telephone Company as construction engineer and salesman. A telephone line which he built in Brooklyn between his boarding house and his father's residence was one of the first in that city. Later he helped in the construction of the first lines in New York City to be operated as a commercial enterprise from the telephone company's offices to nearby points. One of these connected the office of a wire manufacturer in New York with the plant in South Brooklyn, a distance of about five miles. In 1879 Captain Candee became identified with the Weston Electric Light Company, and two years later he assisted in organizing the Jablochkoff Electric Lighting Company in New York City. Captain Candee did much experimental and development work in arc lighting and conceived the idea of telegraphing from a moving train, which he successfully accomplished. In March, 1884, with Mr. Cheever he organized an insulated-wire manufacturing business at Passaic, N. J., under the name Okonite Company, the designation being coined from the telegrapher's "O K" and the last syllable of "vulcanite." Under Captain Candee's direction the Okonite Company has developed an extensive line of insulated wire and cables and insulating materials and established standards of quality that are recognized the world around. Captain Candee for a number of years was associated with the National Guard of New York State as Captain of the Twenty-third Regiment. He was born in Yonkers, N. Y., March 28, 1851.



W. L. CANDEE

Trade and Market Conditions

Business Reviews, Together with Market Letters from Important Trade Centers, on the Supply, Demand and Prevailing Prices of Electrical Apparatus and Supplies

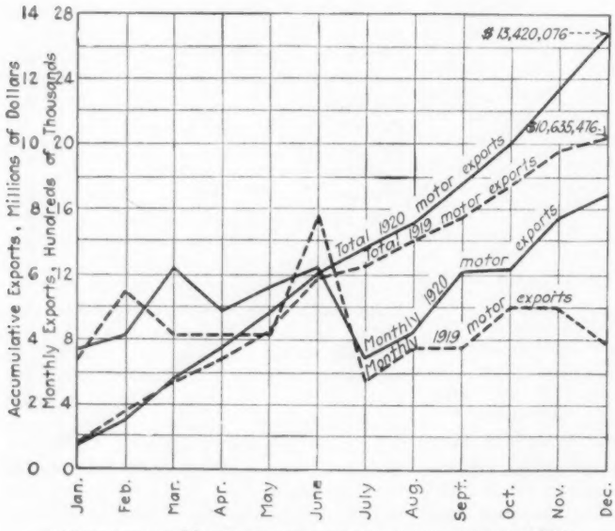
Small Agents' Lamp Business Holding Up Well

WITH the advent of summer and shorter nights it is not surprising to find a recession in lamp business. This has been accentuated by curtailed industrial activities and the discontinuance of night work and seems to be more pronounced in the case of industrial lamps than for other lamps. The business of the smaller agents, however, is holding up well, according to recent advices. Local stocks are good, although factory production is running anywhere from 60 to 90 per cent of capacity. With the increase in industrial activity, however, reported in many sections, this business too should soon show more life.

Sign-lighting business is holding up well, and because of the demand for higher and higher intensities for this application the representative lamp manufacturers have developed 25-watt and 50-watt blue "Mazda B" sign lamps with the coil filament. These are to take the place in sign lighting only of the "Mazda C-2" lamps which have been used to give the blue color but which are of too high temperature to work well in this service.

Motor Exports Greater in 1920 than in 1919

FROM an analysis of motor exports from the United States during the years 1919 and 1920, total exports in those two years amounted to $10,635,476 and $13,420,076 respectively. It is interesting to note that in this compilation, made by the ELECTRICAL WORLD from figures presented by the Bureau of Foreign and Domestic Commerce,



INCREASE OF 30 PER CENT SHOWN IN MOTOR EXPORTS OF 1920 OVER YEAR 1919

the twenty countries, each of which absorbed motors to the value of $100,000 or better in 1920, were the same countries which in 1919 ranked among the top twenty. In addition, Norway in 1919 ranked twentieth in motors but in 1920 dropped below the hundred-thousand line to $59,541.

During 1920 motors held chief place among United States exports, as they did in 1919 and 1918. The month of December supplied the highest figures, March, October, June and September being very close together.

Canada was the heaviest buyer both years, taking 18 per cent of the motor exports in 1920 and 15 per cent in 1919. Japan came second both years and England third. Canada,

1920 AND 1919 MOTOR EXPORTS FROM THE UNITED STATES

Country	Value of 1920 Exports	Value of 1919 Exports	Country	Value of 1920 Exports	Value of 1919 Exports
Canada	$2,404,280	$1,611,317	British South Africa	216,831	307,857
Japan	1,485,734	1,067,949	Peru	205,199	205,881
England	1,279,448	877,478	Chile	162,802	357,082
Cuba	972,087	505,022	Philippine Islands	157,510	267,408
Belgium	704,300	153,113	Dutch East Indies	139,291	181,676
France	700,519	591,227	66 miscellaneous countries importing under $100,000 each	1,043,782	875,139
Australia	660,269	760,150	Total exports of motors	$13,420,076	$10,635,476
China	557,058	440,404			
British India	477,312	572,459			
Brazil	448,131	544,116			
Spain	425,842	343,854			
Italy	406,366	126,721			
Mexico	398,148	427,572			
Argentina	318,399	317,245			
New Zealand	256,768	101,806			

Cuba and Mexico took $3,874,515 in motors in 1920; Brazil, Argentina, Peru and Chile took $1,134,531; England, Belgium, France, Spain and Italy took $3,516,475; Japan, China and British India took $2,520,104, and Australia and New Zealand took $917,037 in 1920.

In 1920 sixty-six miscellaneous countries importing less than $100,000 each took $1,043,782 worth of motors; in 1919, with Norway included at $108,206 worth, these miscellaneous countries took $875,139 worth of motors.

Lighting Fixture Standardization an Immediate Possibility

STANDARDIZATION of the mechanical details of lighting fixure parts bids fair to be an accomplished fact among the members of the National Council of Lighting Fixture Manufacturers if the proposition outlined by Mr. d'Olier at their recent Buffalo fixture market and convention is accepted by the members, according to recent advices from the National Council. The secretary goes on to say:

"The National Council has itself been investigating for some months past this question of standardization, but the system which is now under consideration will if adopted place at the Council's disposal a complete set of gages and templets covering every detail of glassware, heels, globe proportions, lamp positions, etc., which would eliminate the necessity of continuing the researches of the National Council itself in the matter.

"The urgency of adopting a standardization system for the mechanical details of lighting fixtures is recognized by every manufacturer, jobber and retailer in the business. It will eliminate the present necessity for rethreading and fitting when assembling fixtures in the manufacturer's plant. It will enable the parts manufacturer to simplify his dies and other tools and to give more prompt deliveries through the use of rapid production methods. It will enable the fixture dealer to order replacements of glassware and parts with the certainty instead of merely the hope that they will fit when installed.

"There are many proportions which must be included in any lighting-fixture-parts standardization system. The lamp position, for instance, is extremely important, yet it is by no means infrequently found that a lamp position, instead of being a constant dimension for each type of

shade or globe, is different for every make. Another important dimension is that of the 'heel' into the hollow of which the shade-ring screws are screwed. Yet another is the length of the shade-ring screws themselves. Each of these under the National Council's plan would have a definite proportion common to all makers within the organization. The efforts of the National Council of Lighting Fixture Manufacturers along standardization lines will be watched with interest throughout the electrical industry."

Trade Commission Files Complaint Against United States Steel

UPON application made by the Western Association of Rolled-Steel Consumers and other users of steel products, the Federal Trade Commission on April 26 issued a formal complaint against the United States Steel Corporation and eleven subsidiary companies. The case is an outgrowth of conditions complained of by more than 2,700 fabricators of steel in the Chicago, Duluth and Birmingham districts, by Legislatures of three states, by several municipalities and by chambers of commerce and many business organizations throughout the United States. There are implied unfair methods in competition in violation of sections of the commission's organic act and Section 2 of the Clayton act.

In brief, the applicants complain against the device known as the Pittsburgh plus price. Under this device all steel except rails wherever made, and whether made by the Corporation plants or by independents, is sold at the f.o.b. Pittsburgh price plus an amount equivalent to the freight to point of destination.

The complaint charges control by the Corporation and supervision and direction over the business conducted by its subsidiaries, control of a large percentage of raw materials and of the production of semi-finished and other steel products, issuance of price quotations and schedules covering steel except rails wherever made, and whether made by quotations are adopted by all of the respondent subsidiaries and their competitors, leading to the so-called "Pittsburgh base" price, "Pittsburgh plus" price, etc. The respondents are given thirty days to make formal answer.

What Supplies Should Jobbers Emphasize for Sales Efforts?

STARTING with the premise that the jobber does want to sell to the contractor, Charles L. Eidlitz, president of the R. B. Corey Company, New York, has worked out an analysis of the things a contractor buys and has placed a very definite weight on the value of the various electrical items entering into building construction.

At the same time it is Mr. Eidlitz's observation that many jobbers do not seem to want to sell to the contractor. This view is based upon the rather limited knowledge possessed by many jobbers' salesmen of the important items entering into building construction. The reflection is that the average salesman has only a smattering acquaintance with nearly every line carried and would be lost without his catalog.

As a remedy for this Mr. Eidlitz advocates the thorough instruction of jobbers' salesmen in the electrical lines that predominate in building construction. These lines he shows in a chart. Other jobbers' lines can be handled by specialty salesmen, he says, in order not to take up the time of the construction equipment salesmen.

All electrical material has been divided into nine classes by Mr. Eidlitz: (1) Mechanical; (2) energy transmitting; (3) contact making and breaking; (4) insulating; (5) resistance; (6) magnetic; (7) magnetically operated; (8) induction; (9) chemical. His analysis of several large building jobs shows the predominance of classes 1, 2 and 3, and on these the salesman's efforts should be directed.

Class 1 comprises conduit, outlet boxes, panel cabinets, bushings, lock nuts, couplings, fixture studs, hangers, bushettes, non-metallic flexible, metal molding, pull boxes, screws, nails, pipe straps and expansion bolts. Class 2 comprises wire, cord and flexible armored conductor. Class 3 takes in sockets, knife switches, push switches, attachment plugs, fixtures, cut-outs, panelboards, switchboards, oil switches, and bell push-buttons.

On one office building in New York City where $15,562 worth of electrical materials were used class 1 took $5,423, class 2 took $2,176, and class 3 took $7,122. These totaled 94.4 per cent of the total electrical material used on the job. Class 6 used $835 and class 9 $6. Cost of labor was 31 per cent.

On a bank building where the electrical material cost $12,792 class 1 took $6,209, class 2 $1,406 and class 3 $4,854, a total of 98 per cent of the total electrical material used. Class 4 used $15, class 6 $130 and class 9 $3. Labor charge was 40 per cent.

On analyzing a hospital job where it might be thought a large amount of low-voltage material would be used it was found that the electrical material cost $35,790. Of this class 1 took $13,005, class 2 $4,006 and class 3 $13,232. This totals 84.5 per cent. The low-voltage or magnetic equipment under class 6 took $4,498, or 12.5 per cent of the total electrical materials cost. Class 4 took $20, class 7 $850 and class 9 $132.

These figures open up an interesting subject and certainly can be said to cover the bread-and-butter materials of the electrical supply jobber. At the same time, it would be illuminating to analyze these costs for residence wiring, store wiring, loft and factory wiring, etc.

The Metal Market Situation

THE copper market is without essential change, but a more confident tone exists among producers. This is a result of the increase of deliveries into domestic consumption of 10,000,000 lb. during April to 70,000,000 lb. Consumers claim this is the result of delayed shipment on contracts, but producers' stocks at any rate are decreasing rather than increasing.

Some small lots of copper may still possibly be obtained at 12.62½ cents delivered for prompt shipment, but in general, producers are firmly holding electrolytic at 12.75 cents for May and June, with July quoted at 13 cents. In the outside market sales are light as the supply of copper held is small and prices asked are fully as high as producers'.

The strengthening of the lead market due to continued firmness abroad and curtailed production at home has resulted in another price increase, which makes a total advance of ½ cent over the previous low price. The New York "official" lead price of 4.50 cents per pound is still about ¼ cent below the outside market there. The zinc market is quiet with producers firmly maintaining their prices.

While dealers in the scrap market are waiting for general buying to open up the market shows very little life. Two little bright spots appear in a slightly higher quotation on better grades of scrap copper and on heavy lead. The lead, however, does reflect some life but the copper is quiet. There is not so much demand for lead for batteries for new automobiles as there was last year but for replacement batteries the call is good. There is little speculative scrap buying even under the low prices existing; the activity is for hand-to-mouth needs.

NEW YORK METAL MARKET PRICE

	April 26, 1921	May 3, 1921
Copper	£ s d	£ s d
London, standard spot	70 5 0	71 5 0
	Cents per Pound	Cents per Pound
Prime Lake	12.75—13.00	12.75—13.00
Electrolytic	12.75	12.75
Casting	11.62½	11.75
Wire base	14.50—15.00	14.50—15.00
Lead, trust price	4.35	4.50
Antimony	5.25	5.25
Nickel, Ingot	41.00	41.00
Sheet zinc, f.o.b. smelter	11.00	11.00
Zinc, spot	5.45	5.45
Tin	32.00	31.62½
Aluminum, 98 to 99 per cent	28.00	28.00

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	9.50—10.25	10.00—10.50
Brass, heavy	5.50— 5.75	5.50— 5.75
Brass, light	3.75— 4.00	3.75— 4.00
Lead, heavy	3.50— 3.75	3.75— 3.90
Zinc, old scrap	2.87½— 3.00	2.87½— 3.00

THE WEEK
IN TRADE

Prices When Quoted Are Those Prevailing at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

EVEN though reports from all over the country indicate the general quiet tone to business, an analysis of the industry will show a not unhealthy volume of business when taken in the light of pre-war buying. Of course it isn't up to the capacity of plants, but that capacity is based on war-time requirements.

One good reason for building slackness is the refusal of building labor to accept a wage reduction. Since May 1 strikes in this industry have been called in nearly all sections on this account. Strikes have also been called in printing and paper trades in several cities, as well as one of marine workers on merchant vessels. Chicago's interest now is in indictments in the building trades. Non-employment in New York State is high, but conditions are getting better in the Middle West, the Inter-Mountain regions and the Northwest. Collections are a little more satisfactory in New York and St. Louis, but are a little slower in New England.

There is a resumption in building in the Boston territory and an increase in wiring supply orders on jobbers. Ranges are selling well there. Wire sales on the West coast are better along with small utility motors. Car loadings of lumber are quite high in the Northwest. The industrial situation around Chicago is gradually improving. A wage reduction of 20 per cent, effective May 16, has been announced by the U. S. Steel Corporation.

NEW YORK

There is little consistency to business as reported by different jobbers. Some say there is no improvement in the situation, others report it as spotty, while some are finding the high spots a little closer together. Taken all in all and boiled down, the result would, of course, show a quiet market, but probably one that is tending to improve slightly. The consensus of opinion is that the bottom of things has been reached and the ascent begun.

Collections are evidence of this. Railroad accounts are very slow, but others are running about sixty days and show improvement of late. With the recent drop on conduit electrical prices represent marked declines, with the exception of schedule material. Jobbers are not buying a thing for stock, however, and are able to keep inventories very low because of quick prevailing shipments.

The building situation is quiet, but it shows some improvement. The tax exemption ordinance on dwellings is having its effect on the plans filed for apartments, which represent an increase of more than 600 per cent this year thus far over last. Non-employment is one of the pressing problems in this territory at present. It is estimated that there are nearly half a million unemployed in New York State, of which number half are concentrated in the largest city. The situation is augmented by the strike of 40,000 marine workers and 6,000 firemen against a 15 per cent cut in pay.

Rubber-Covered Wire—Good stocks are held and demand on the whole is not large, though a few jobbers report pretty fair sales. For No. 14 single-braid, in 10,000-ft. lots, from $7.25 to $8 per 1,000 ft. is asked.

Tape.—Very little is moving at prices that range all the way from 38½ to 45 cents per pound on friction and 36 to 50 cents on rubber tape, standard grades, in 100-lb. lots.

Conduit.—Prices are gradually trending lower in line with the recently reduced cost of pipe. This week, in 2,500-ft. lots, ½-in. black sells for $61 to $65.25; ½-in. galvanized, $66 to $74.75; ¾-in. black, $82.50 to $84.85; ¾-in. galvanized, $90.60 to $94.90, per 1,000 ft. There is some movement in the average stocks held, but it is not large.

Non-Metallic Flexible Conduit.—In 1,000-ft. lots the ⅜-in. size brings from $22.50 to $27.70 and the ½-in. size from $25 to $30 per 1,000 ft. Demand is slow.

Flexible Armored Conductor.—Prices are unchanged with 1,000 ft. of No. 14, two-wire, double-strip selling for $59 to $65, though more jobbers are coming to quote the middle price or around $62 to $63. Quite a little of this material is moving, but supplies are so easy to obtain that jobbers are not carrying very large stocks.

Metal Molding.—Jobbers are carrying only fair amounts in stock ranging from about 2,000 ft. to 5,000 ft.; demand is only fair. One thousand feet of "Wiremold," "National," etc., three-wire to four-wire size, sells for $62 to $70.

Sockets.—These are hardly moving at all, though there are plenty on the market and in some cases more than enough. Jobbers are quoting 20 per cent off list in standard package lots, but they rather freely express the opinion that maintenance of prices here is holding up improvement of the electrical market.

Safety Switches.—A couple of large houses at least report that demand has picked up within the last two or three weeks, but others state that there is no call. Very few are carried in stock. Prices are steady.

CHICAGO

The acuteness of the labor situation in the building trades has absorbed all interest in Chicago for the past week and has precluded the possibility of any active market. Some weeks ago the various employers' associations gave notice to the Building Trades Council that, effective May 1, the wage scale would be reduced from $1.25 per hour for skilled labor and $1 for unskilled, to $1 and 75 cents respectively.

All unions have refused to accept the cut and as a result all building in Chicago was scheduled to stop April 30. Some contractors, however, will go ahead under the old scale, thus permitting a large volume of apartment and home building to proceed. Among the jobs which will be tied up in Chicago are the Federal Reserve Bank and the Union Station. It is estimated that $35,000,000 worth of work actually under way will be halted.

Building permits, which have averaged around $2,000,000 per week so far this year have slumped on account of the wage controversy. This week's figure was swelled by a permit for a new bank building to cost $9,000,000, but outside of that ordinary permits aggregate only $500,000.

The industrial situation throughout the district, aside from the construction field, is showing gradual improvement. The automobile centers are gradually becoming more active, and the steel interests in the Calumet district are daily making small additions to their working forces. All retail lines report a slight improvement in trade as a result.

There have been no price changes reported in any electrical line and what little electrical business is being done is of a purely routine character.

BOSTON

Trade displayed little change in volume this past week. Good sales of labor-saving appliances resulted from the "Home Beautiful Show" at Boston, which closed April 30. Some jobbers report better wiring supply orders from contractor-dealers, following resumption of building operations in the city proper and suburban territory. Prices reflect some instability in sales, rubber-covered wire being weak and retail sales subject to reductions to move stock. A reduction averaging about 7½ per cent in the prices of single-phase and automatic starting polyphase Century motors was put into effect last week. Jobbers are buying very moderately from manufacturers. Collections are a little slower this week. The liquidation of labor con-

tinues and a threatened traction strike covering eastern Massachusetts outside of Boston appears to have been averted. Woolen, shoe and some of the metal industries are fairly well occupied. The demand for electric ranges is picking up rapidly, and in retail trade moderate buying is evident.

Ranges.—Increased activity is occurring, and five leading Boston jobbers have ordered a total of 640 ranges of a single make within the past month. Interest in fireless cookers is increasing. A representative range outfit is being sold to the retailer for $130. Vigorous merchandising is being rewarded.

Motors.—Interest in motors is at a low ebb for the time being and stocks are above current requirements. Spasmodic sales are occurring, but inquiries are in light volume. Century motors in some designs sustained a 7½ per cent reduction in price last week.

Rigid Conduit.—Little of this material is moving and deliveries are easy. A leading jobber quotes $67.30 per 1,000 ft. on ½-in. black in any quantity; ½-in. elbows are selling at $16.18 per 100. For ½-in couplings $5.96 per 100 is asked.

Meters.—Jobbers carrying meters are having no trouble in meeting deliveries as the demand is only moderate. Prices are steady.

Tape.—Small amounts are moving on the basis of about 50 cents per pound in 100-lb. lots, very light orders being booked as high as 60 cents. Good stocks rule.

Wire.—Quiet conditions still prevail, although some sales are being made to contractors and to central-station companies. No. 14 rubber-covered sells at $7.25 to $7.35 per 1,000 ft. in 5,000-ft. lots. Bare base is about 16 cents and weatherproof base 16.5 to 17 cents. Plenty of wire is in hand.

Portable Lamps.—Better sales are reported. Retailers are still heavily stocked in many cases, but the public is responding to vigorous sales efforts. Fixtures are moving a little faster.

Flexible Armored Conductor.—Moderate sales are being handled, and No. 14 double-strip sells at $60 to $65 per 1,000 ft., in 5,000-ft. lots. Goods stocks are in hand.

Schedule Material.—Sales are considerably below normal, but the improved outlook in the building industry warrants a better feeling in the Boston market.

Appliances.—Washers and cleaners are selling in fair quantities and much prospective business was uncovered at the recent Boston show. While the appliance business as a whole is spotty, the outlook is generally considered to be excellent.

ST. LOUIS

Jobbers this week report business to be considerably better than the average for the last few months. No large orders are reported, but the volume of small business has been extremely satisfactory considering general conditions. Inquiries show an increase in number and value, and the indications point to substantial improvement faster than many expected. Collections remain at an average of about sixty days, but because of improved business conditions in the territory it is felt that credit is more substantial than heretofore.

Some new building is under way, and a volume of large construction work is planned and ready for execution as soon as costs are more warrantable. In considering the volume of construction work there is a tendency to compare it with that existing in the boom period of 1919 and the first part of 1920. As a matter of fact, the estimated cost of work for which building permits have been issued in St. Louis for the first three months of this year exceeds that for the same period in 1919 by 60 per cent and is 40 per cent of that for the first three months of 1920, when building in St. Louis was on a scale far in excess of any previously experienced. The values for the first three months of each year are as follows: 1919, $1,263,954; 1920, $4,837,923; 1921, $2,022,275. These figures are for the city only and do not include any permits for buildings in the surrounding industrial or residential territory.

Non-employment is not as bad in St. Louis as in some other cities. The Federal Reserve Bank of St. Louis made a study of 102 concerns as of April 1, 1921, and found that there is a decrease of 22 per cent in the number employed and a decrease of 26 per cent in the total payroll wages. The comparatively healthy condition of St. Louis business is attributed to the fact that the largest single industry, that of shoe manufacturing, employs but 8 per cent of the total employees in all industries, there consequently being a wide diversity of employment.

Wire.—The demand for No. 14 rubber-covered continues good, but the demand for the larger sizes and for weatherproof and bare wire is still slow, though with indication of betterment. One large jobber has reduced the price on rubber-covered from an 18-cent to a 16-cent base, thus meeting the market price established by other jobbers. In 25,000-ft. lots No. 14 can now be purchased from $7 to $7.30 per 1,000 ft. Stocks are in fairly healthy condition.

Tape.—Both friction and rubber tape are meeting with a reasonable demand. Stocks are in good shape locally, and prompt shipment from manufacturers can be had. In 100-lb. lots friction tape sells at 36 cents per pound, and rubber tape at 38 cents.

Loom.—Practically no sales of loom are reported for the week, and stocks of some jobbers are quite heavy. A representative quotation for 5,000-ft. lots is $21 per 1,000 ft. for 3/32-in. and $22 for ¼-in. In 1,000-ft. lots the quotations are $2 higher.

Lamp Cord.—Most jobbers report the demand for lamp cord exceptionally quiet, and stocks are larger than they should be. No. 18 twisted cotton pair is quoted at $16 per 1,000 ft. in 5,000-ft. lots.

Conduit.—Little change in the demand or supply of conduit is reported. One-inch black is quoted at $130 per 1,000 ft. by a representative jobber and ½-in. black at $66.10, both in carload lots. Other quotations on ½-in. black vary from $61 to $70.

ATLANTA

Little or no specific change is to be noted in business activities since last week despite the fact that the general impression of business men is that conditions are slowly but surely righting themselves. Several of the large electrical jobbers are in receipt of an unusual number of requests from contractors and dealers asking for cancellation of orders they had placed for household devices. Washing machines seem to be leading in the number of cancellation requests. This apparently unfavorable sign is somewhat offset, however, by the receipt of an increasing number of requests from larger and more progressive contractors for bids on material required for electrical installations in industrial plants. Jobbers report that the volume of business anticipated for the month of April did not materialize, one of the largest jobbers reporting a decrease of 25 per cent in April sales from the March volume. Construction has been stimulated by the lower price of building material and the action of the bricklayers and masons in the reduction of wages, while the recent action of the carpenters' union in reducing their wage scale 10 cents an hour will lend further stimulus to the movement. Building permits for the month of April in Atlanta number 320, valued at $77,358, and New Orleans also reports a healthy increase in the amount of construction under way and proposed. It might be of interest to note that the *Manufacturers' Record* states construction under way and proposed in the South for the week ended April 22 amounted to approximately $40,000,000.

Fans.—Both desk and ceiling fans are going out in good volume to the retail trade, though retailers' stocks have not as yet begun to move briskly except in the extreme Southern section. Jobbers report the 12-in. oscillating fan the most popular size. Sufficient stocks are on hand for the anticipated demand.

Commercial Lighting Fixtures.—This line seems to maintain its activity of the past few weeks, semi-indirect units of the better class leading the movement. Manufacturers have guaranteed no price reduction for three months. Local stocks are in good condition.

Non-Metallic Flexible Conduit.—This is very sluggish with stocks reported at above the average, though one or two jobbers have succeeded in reducing their supplies to normal. A price of $20 per 1,000 ft. is offered on ⅜-in.

Lamp Cord.—A price reduction of 10 per cent was recently announced, present quotations being on the basis of $18 per 1,000 ft. Stocks are plentiful and the movement is rather slow.

Flexible Armored Conductor.—Movement continues with fair satisfaction owing to the tendency to substitute for conduit wherever possible. Stocks are in excellent shape, some jobbers still having supplies above their requirements.

Portable Drills.—While the sale of this specialty to garages is almost at a standstill, a fair quantity of drills of the more popular size is being ordered by industrial plants. No changes in price have been reported recently. Stocks are reported in fair condition on the popular sizes.

Flashlights.—Practically no demand for flashlight cases is unearthed, but jobbers report batteries and lamps continuing to move very satisfactorily. Stocks of all three items are plentiful.

SEATTLE—PORTLAND

In Seattle, Portland and the Northwest generally several of the more important jobbers now state that they do not look for a return of normal business before the latter part of the summer, if then. The present market for electrical material is quiet, and from indications it will remain so for some time to come. Retailers are very cautious in their buying, partly because of money tightness but also on account of poor demand. However, manufacturers report that while business is not materially changed there is a feeling of greater confidence being expressed. This does not mean that there is anything affecting general business, but it augurs well for the future. Jobbers report a slight upward tendency in business, although as yet it is not a great factor. Stocks are being kept in good shape, the only shortage, if it could be so construed, being in porcelain and larger size motors. Lack of demand for these two, however, makes the supply more or less immaterial. There is no change in the collection situation, and generally speaking there is no credit requested or extended.

While there are reports each week of sawmills starting, there are still a large number idle. However, carloadings of forest products on the lines of the various Northwest railroads reached last month an average nearly as large as a year ago, owing solely to the increasing improvement in the lumber business. Figures supplied by railway companies on shipments to the East indicate that the swing upward has begun, and lumber seems to be moving more freely than shingles. New building construction, particularly in Portland, Tacoma and Spokane, including commercial and residence structures, is gradually increasing. The building program in Seattle, with the exception of residence work, is still lagging and from present indications will not be in full swing until late in the summer, if then. The employment situation in Seattle and the Northwest generally is showing improvement, and it is believed the worst of the situation will be over within a month. Reopening of camps and mills and farm demands are absorbing encouraging numbers of men. Wages are tending downward in all lines.

Panels and Switchboards.—Trade, which has been very quiet during the past few months, is slowly showing signs of improvement. Stock in plenty is on hand. Prices are tending downward, although no recent drops have been noted.

Farm-Lighting Outfits.—The activity in this equipment is reported considerably lighter than originally expected; in fact, there is little or no movement and none now is expected until early fall. Reports from eastern Washington and Oregon indicate that farmers are far from optimistic over their prospects for 1921 and are confining expenditures almost entirely to necessities.

Heating Appliances.—Dealers throughout this section as a whole report absolute quiet. Stocks are in good shape.

SAN FRANCISCO

An arbitration board of three men, selected last year by committees from the unions and the employers' associations, recently advised that average reductions of 7½ per cent be made in the wages of the building trades unions. These bodies now propose a strike in answer to the reductions. The recent allotment of several large Shipping Board steamers to San Francisco and the re-establishment of several other steamers on their old runs stimulated shipping industry in the bay region.

Two very successful merchandising conferences were held by the General Electric and Westinghouse companies during April in cities of the Pacific Northwest and north California, and these conferences are now extending into Los Angeles territory. These have been productive of great interest and it is felt they will greatly help merchandising.

Conduit.—There has been a 3 per cent reduction in rigid-iron conduit, the new prices being $8.10 per 100 ft. in 10,000-lb. quantities of ½-in. sherardized and galvanized pipe. Local stocks are good and demand is fair.

Boxes and Covers.—Another roughing-in. line to drop recently is the box and cover line, a 20 per cent decrease being just reported on the rigid iron boxes and a 10 per cent decrease on boxes for flexible non-metallic conduit. Sales are rather scattering.

Rubber-Covered Wire.—Rubber-covered wire prices are now running about $7.75 per 1,000 ft. in 5,000-ft. quantities for the No. 14 single-braid, solid, rubber-covered. Sales of wire run larger proportionately than the sales of other staples because many contractors believe that the lowest mark is just about reached, whereas it is felt that the steel market will show further marked reductions.

Motors.—An increasing demand for small utility motors is reported by dealers in the interior towns and cities. These motors are about ⅓ hp. in size and are so arranged that they can be used for a variety of purposes about the farm. The list averages $50 each.

Vibrators.—A marked decrease in the call for vibrators and violet-ray machines is commented upon by local merchants. A serious cause of complaint has been the servicing of these machines, which are subject, of course, to considerable abuse.

SALT LAKE CITY—DENVER

Jobbers' trade in general is about 70 per cent off the trade of a year ago, but with prices much reduced this percentage represents a larger volume of merchandise moving to the retail dealer. The electrical industry is holding up to a good average. Building activity is slowly resuming with residences of average cost predominating. The employment situation is easing to some extent. Collections are continuing slow.

Lamp Cord.—Stocks are in good shape with an extremely unstable price condition. The demand is fair and constant.

Rigid Conduit.—With small activity in building sales, a 5 per cent reduction has been made within the last few days; ½-in. and ¾-in. sizes prevail in the regular demand.

Non-Metallic Flexible Conduit.—Stocks are plentiful. One reduction only has been made in the past few months; ⅜-in. size brings $26 per 1,000 ft. and deliveries are good.

Pole-Line Material.—Movement is in small quantities only and most of the demand is for materials in repair work. Few construction jobs of any consequence are now under way. When construction will resume is uncertain, but it is well known that there is big need of extensions.

Safety Switches.—These are little used in this region, since there is no law requiring them. The tendency to their use, however, is growing. Panel boards are in fair demand.

Insulating Materials.—There is small demand, with stocks more than ample to meet all requirements. Prices are characterized by stability.

Fans.—As yet dealers are showing little interest and indications are that they will not stock extensively until the actual consumer demand is in evidence. A good fan season is looked forward to by both dealers and jobbers. Stocks are varied and plentiful.

Manufacturers' Activities

Devoted to the Business Side of Manufacturing, Distribution and Sales, News from Jobbers and Foreign Fields and a Record of New Devices and Trade Literature

Associated Manufacturers to Meet at New London in June

All sections of the Associated Manufacturers of Electrical Supplies will hold their regular summer meetings and the board of governors will hold its June meeting at the Griswold, Eastern Point, New London, Conn. Reservations have been made for the period June 25 over July 4, but the dates for the meetings are June 27, 28, 29 and 30.

Changes in Schimmel Electric's Lighting Department

As part of the plans for the expansion of the Schimmel Electric Supply Company in connection with its removal from 318 Market Street to new and enlarged quarters at 526 Arch Street, Philadelphia, after alterations have been completed, is the appointment of Randolph E. Tyler to be in charge of the company's lighting department. Benjamin Hayllar, Jr., will devote his time exclusively to the lighting needs of industrial plants in and about Philadelphia.

Peerless Equipment Purchases Repair Tool Companies

The entire business of the Electrical Manufacturers' Equipment Company, Chicago, has been sold to the Peerless Equipment Company, Hanover, Pa. This includes the manufacturing and selling of those products known under the trade name of "Segur" coil-winding tools and allied equipment. The Peerless company has announced that it will combine the manufacture of this new line with that of "Peerless" armature repair tools, which business also it has recently purchased from the Manley Manufacturing Company, York, Pa. The Electric Service Supplies Company, New York, will continue to act as exclusive selling agents for the Peerless Equipment Company.

Cadillac Washing Machine Purchases Odin Company

The Cadillac Washing Machine Company, 325 West Ohio Street, Chicago, has purchased the physical assets of the Odin Company, Chicago, and is continuing the manufacture of its machine under the name "Cadillac." The Odin Company has entirely discontinued the manufacture of washing machines. While no radical changes have been made in the construction of the machine, a few minor improvements have been made and new methods of production installed in the factory. The present output of machines is very limited, says President Payne, but increased production has been planned and is being carried out as rapidly as possible.

Arrangements are also being made to acquire another factory where two new types of machines will be manufactured and as soon as the production of the present type and the two new types has been increased the company expects to inaugurate an intensive selling and advertising campaign on all three models. H. D. Payne is president and general manager of the new company, S. T. Sjoberg is vice-president and consulting engineer and C. L. Hibbard is secretary and treasurer.

Western Union Organizes Own Purchasing Department

As of May 1, the Western Union Telegraph Company, 195 Broadway, New York City, has organized its own purchasing department. This procedure had been followed by the company up to 1912, when it entered into a contract with the Western Electric Company whereby the Western Electric acted as purchasing agent for the Western Union. This contract has not been renewed for this year. Charles S. Voorhees is the new general purchasing agent, but the department is under the supervision of one of the vice-presidents of the Western Union.

The Western Union had four points of contact with the Western Electric in reference to supply bases. These were in New York City, Chicago, Atlanta and San Francisco. Under the new organization, which also includes a supply department in charge of W. G. Higgins as superintendent of supplies, these same four general centers of the country have been retained as supply and warehouse bases for the large amounts of line and station material required by the company. Besides the warehouse in Atlanta, new depots have been secured in San Francisco and in the Bush Terminal in Brooklyn, N. Y., and the former Western Union base in Chicago will again be utilized.

Universal Crane's New Factory in Operation

The new steel-frame and brick factory, 180 ft. x 110 ft., of the Universal Crane Company at Elyria, Ohio, has been completed and equipped. This plant has been put in operation and greatly increases the productive capacity of the company.

Rickard & Company Follows from Reorganization

The technical advertising agency of Rickard & Sloane has been reorganized as of May 1 under the name Rickard & Company, 25 Spruce Street, New York City. Mr. Sloane has not been with the company for six years, and with the growth of the business it has been decided to change the name and effect a new organization. W. L. Rickard is president, O. S. Tyson, formerly Eastern sales manager ELECTRICAL WORLD, is vice-president, Julian Gran, treasurer, L. F. Maher, secretary. Directors are Messrs. Rickard, Tyson and Gran and J. R. White, H. F. King and H. L. Fisher.

Increase Reported in Flexible Cord and Wire Business

With the Diamond Branch of the Rome Wire Company, on Clyde Avenue, Buffalo, N. Y., equipped for a capacity of about a million feet of finished product a day, reports show that business is getting better each month, although output is still well below plant capacity. There is a feeling of satisfaction at the plant over the volume of business now coming through under existing circumstances. Flexible wires and cables are manufactured there with a view to specialization, and it was to that end that the machinery and equipment were designed when the 75,000-sq.ft. addition was begun last April. The company already had 60,000 sq.ft. of manufacturing space when it located in Buffalo early in 1920. Wire drawing, annealing and tinning also are carried on at the plant.

Ideal Electric's New Factory for Synchronous Motors

The Ideal Electric & Manufacturing Company, has recently erected a new factory at Mansfield, Ohio, in order to accommodate the increased production required to manufacture its new line of synchronous motors. These fill out its regular line of direct-current and alternating-current power apparatus.

Allis-Chalmers 1920 Billings Total $31,516,209

In the eighth annual report of the Allis-Chalmers Manufacturing Company for the fiscal year ended Dec. 31, 1920, on sales billed of $31,516,209 there was a manufacturing profit of $4,177,128. After adequate provision for federal taxes and general contingencies, the net profit for the year 1920 was $3,564,248, compared with $3,599,713 for the preceding year. Inventories of work in process, manufactured stock, raw materials and supplies amounted to $19,659,225 on Dec. 31. At this time the value of unfilled orders, including all customers' contracts unbilled and in various stages of completion, was $17,046,724. Total bookings for 1920 were $32,696,566.

Capital expenditures for buildings, machinery and equipment amounted to

$1,852,917, principally in connection with the building and equipping of a new iron foundry at the West Allis works and additions to buildings and equipment at the Bullock works. Net working capital increased $1,820,977. On preferred and common stock of $42,500,000, current and working assets are $30,487,240 and current liabilities are $6,603,379, leaving net quick assets of $23,883,860. Accounts receivable total $7,094,989.

Motor Repair Company Establishes Brush Department

The Electric Motor Repair Company, 627 Myrick Building, Springfield, Mass., has established a separate brush department in its organization and will henceforth market its carbon brushes under the trade name "Mohawk carbon brushes." The company, in addition to its electrical maintenance work, began to make carbon brushes about two years ago in a small way, and the increasing demand has necessitated providing for production departmentally. In announcing this extension of its organization the company states that it is usually prepared to make immediate deliveries on brushes for both generator and motor service. J. B. Tufts is treasurer of the company.

Eveready Gains 37 per Cent in First Three Months

More than 200 firm members and buyers of electrical hardware, automobile accessory jobbers and drug jobbers of Greater New York were the guests of the American Ever Ready Works at the Long Island City factory on April 22.

The event was a "business revival" luncheon to celebrate the fact that so far as the Eveready flashlight and battery lines are concerned improved business conditions have already taken place.

Executives of the American Ever Ready Works quoted figures for January and March and stated that a 37 per cent increase in distributers' purchases over the company's estimated sales was shown this year, thus indicating conclusively that the retail trade and the buying public demand more flashlights and batteries than ever before.

F. A. Wilson-Lawrenson, vice-president, emphasized the company's standard policy of distributing its flashlight product exclusively to jobbers and announced the continuance of that policy so long as distributers cooperated in holding and increasing the business and giving acceptable service to the retail trade. R. A. Wentworth, in charge of factory production, announced important improvements in the Eveready flashlight line, stating that the company had spent the past two years in special experimental work in the study of light, with the result that flashlights can now be produced that will concentrate or diffuse light, exactly as desired. Mr. Wentworth showed samples of two new types of Eveready flashlights to be known as Eveready "Spotlights," which will be placed on the market immediately, and explained their new constructional features, such as new parabolic reflectors, a special concentrated filament "Mazda" lamp, a shock absorber, a focusing device and an end-cap container holding two reserve lamps. He also showed samples of new Eveready "Spreadlights," a new lantern type, and the new Eveready unit cell flashlight batteries.

Marquis Regan, merchandising counsel for the company, told of the growth of flashlight business until he thought it the second largest specialty product in the electrical field and stated that one person in every ten throughout the United States is a flashlight user. "During the first fifteen years of its history Eveready placed on the market 379 types of flashlights," said Mr. Regan. "During recent years the company made seventy-seven different types. By the end of 1921 the line will have been reduced to twenty-six types only."

McKenney & Waterbury Add to Their Representation

The McKenney & Waterbury Company, Inc., which has been developing its general jobbing business since its reincorporation, has been appointed representative of the entire line of Hotpoint heating appliances. Recent additions to the company's list of manufactured products include "Red Seal" dry cells and Hamilton-Beach motors.

Gainaday Electric Succeeds Good Housekeeping Appliance

The Gainaday Electric Company of New Jersey has recently been incorporated in New Jersey with a capital stock of $200,000 and succeeds the Good Housekeeping Appliance Corporation of Newark, having secured a controlling interest in that company. The new company is not a manufacturing company but confines its activities to the sale of Gainaday electric washing machines, ironing machines, vacuum cleaners and other household appliances.

Headquarters will be at 587 Broad Street, Newark, and branches operating through the main office at Newark have already been established at Brooklyn, N. Y., and Summit, Plainfield, Red Bank and Ridgewood, N. J. W. L. Rodgers, president of the Pittsburgh Gage and Supply Company, is president; Joseph Ewing is vice-president and general manager; E. J. Checkley, vice-president of the Pittsburgh company, is treasurer and L. J. McCarthy is secretary.

Electric Steel Plant Bought by Link-Belt

The Link-Belt Company, Philadelphia, has purchased the plant of the Dodge Steel Company at Tacony, Pa., for the manufacture of electric steel castings. The plant was constructed only last year and comprises about five acres of property. Present operating capacity is about 150 tons per month, but the Link-Belt Company plans to use only one-third of this capacity for its own uses and the remainder to supply the needs of local manufacturing establishments.

The steel company will be operated as a separate corporation under the name Dodge Steel Company, the officers being Charles Piez, president, and Staunton B. Peck, vice-president of the Link-Belt Company, president and vice-president respectively, and Chester S. Roberts, secretary, treasurer and manager.

The General Electric Company has moved its Denver (Col.) offices to the newly built United States National Bank Building. Greatly improved facilities have been obtained in the new location, which is in the center of the Denver financial district. H. D. Randall is district manager.

The Engineering Business Exchange, 30 Church Street, New York City, has established a Southeastern branch in the McLachlen Building, Washington, D. C. This office will be in charge of Marshall O. Leighton, consulting engineer, as director and will cover the territory from Maryland to Alabama inclusive.

The Electrical Engineering Company, Pittsburgh, has acquired property at 208-12 Cremoe Street, Northside, with factory, where it proposes to establish new works.

The Chicago Fuse Manufacturing Company has removed its New York office from the downtown section to the Tilden Building, 105 West Fortieth Street.

French & Hubbard, consulting engineers, Boston, have moved their offices from 88 Pearl Street to 210 South Street.

The National Council of Lighting Fixture Manufacturers has moved from 8410 Lake Avenue to 231-233 Gordon Square Building, Detroit Avenue at West Sixty-Fifth Street, Cleveland.

Pass & Seymour have removed their New York offices from 6 Church Street to 71-73 Murray Street.

The Superheater Company has removed its New York offices from 30 Church Street to 17 East Forty-second Street.

The Electric Service Engineering Company has moved its New York offices from 1416 Broadway to 105 West Forty-seventh Street.

The Mechanical Appliance Company, Milwaukee, manufacturer of Watson motors, announces the removal of its Buffalo district sales office from 318 Prudential Building to 311 White Building. W. C. Winterroth is in charge of this office.

The William C. Krauth Electric Company, Louisville, Ky., has filed notice of increase in capital stock from $20,000 to $50,000.

The Onondaga Auto Electric Service Company, Syracuse, N. Y., has filed notice of increase in capital stock from $75,000 to $112,500.

The Williamsburg Flint Glass Company has moved its New York office and sample room from 123 Chambers Street to 290 Broadway.

The Bristol Company, Waterbury, Conn., manufacturer of electric measuring instruments, has filed notice of increase in capital stock to $2,500,000.

The Finch Radio Electric Corporation, Buffalo, N. Y., has filed notice of increase in capital stock from $10,000 to $500,000, the proceeds to be used for improvements and expansions.

W. E. Quimby, 209 Parkhurst Street, Newark, N. J., manufacturer of electric pumping apparatus, has filed plans for the erection of a two-story addition, 40 ft. x 96 ft., to cost about $25,000.

The Ross Heater & Manufacturing Company, Inc., Buffalo, N. Y., manufacturer of boiler feed water heaters, surface condensers, evaporators, etc., announces the opening of a branch office in the New York district at 2 Rector Street. T. M. Hardin, formerly with the home office, will be in charge.

The Evansville Electrical Manufacturing Company, Evansville, Ind., which started operation last August, has been incorporated with a capital stock of $25,000. The company manufactures bronze bearings, trolley wheels, mine supplies, etc. John Polling is president.

The Big Sandy Electrical & Repair Company, Pikeville, Ky., recently organized, is planning to erect a machine shop and electrical repair works, 40 ft. x 70 ft. E. S. Shurtleff is president.

The American Electrical Supply Company, 953 Washington Boulevard, Chicago, it is reported, will soon ask for bids for the construction of a three-story building, 110 ft. x 120 ft., at 117-21 South Morgan Street, to cost about $100,000.

The Bovaird & Seyfang Manufacturing Company, Bradford, Pa., manufacturer of steam engines, boilers, etc., is reported to have taken bids for the construction of two one-story additions, 150 ft. x 187 ft. and 87 x 110 ft., to cost with equipment about $100,000.

Foreign Trade Notes

McDOUGALL, PEASE & FRIEDMAN, Montreal, consulting engineers, announce that they have moved their offices from 511 St. Catherine Street, West, to 85 Osborne Street.

THE DIAMOND STATE FIBRE COMPANY OF CANADA, LTD., Toronto, has established a branch office at 84 St. François Xavier Street, Montreal, in charge of J. Alexander Regan.

SHORTAGE OF TELEPHONE MATERIAL IN CEYLON. — According to the *Electrician* there is a very serious shortage of telephone material in Ceylon, and in Colombo alone there are several hundreds of applications for telephones awaiting attention, while the outstations are even worse in this respect. Of the material ordered in 1913 only a portion, including a switchboard capable of accommodating some 300 subscribers, was safely landed, the remainder being lost through the torpedoing of the steamer.

TARIFF REMITTED ON ELECTRICAL MACHINERY IN AUSTRALIA.—The Tasmanian government, according to the *Electrician*, has succeeded in getting the Commonwealth government to remit the customs duties on machinery imported for the extension to the state hydro-electric project. It has been decided to permit the importation of all machinery which could not be reasonably manufactured in Australia. This decision will apply to the plant which the Tasmanian government is now importing to extend its system.

D. J. BEATTY, formerly advertising manager for the Northern Electric Company, Montreal, has severed his connection with that concern to go into partnership with G. L. MacGillivray in the G. L. MacGillivray Company, Ltd., Montreal, which was recently organized to take charge of the sales of the following firms in eastern Canada: Edwards & Company, Inc., American Insulator Corporation, Waterbury Manufacturing Company, Chase Metal Works, Parker Supply Company, Inc., and the Prometheus Electric Company, as well as the R. M. Radio Company of London, England.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A manufacturer in Switzerland (No. 34,763) desires to purchase or secure an agency for the exploitation in Switzerland or the European continent of an article of the electrotechnical branch.

An import company in the Bahamas (No. 34,765) desires to purchase electrical equipment for the use of general contractors and builders.

New Apparatus and Publications

SYNCHRONOUS MOTORS. — The Ideal Electric & Manufacturing Company, Mansfield, Ohio, has issued a bulletin on its new synchronous motors.

COPPER.—"Copper from Mine to Finished Product" is a publication of the Anaconda Copper Mining Company, 25 Broadway, New York City.

TRANSFORMERS. — Bulletin 2005 describes "Pittsburgh Power Transformers" of the Pittsburgh Transformer Company, Pittsburgh.

FLEXIBLE CORDS AND CABLES.—The Simplex Wire & Cable Company, 201 Devonshire Street, Boston, has developed solid-rubber-covered reinforced two-conductor and three-conductor portable cords and cable for heavy duty.

ENGINEERING.—Warren D. Spengler, engineer, Hanna Building, Cleveland, is publishing a series of "Engineering Service Talks."

JUNCTION BOX BREAKER.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has recently placed on the market type "JB" air-break switch, 250 volts, single-pole.

PORTABLE SIGN UNIT.—The Economical Electric Lamp Division, National Lamp Works of General Electric Company, 25 West Broadway, New York, has placed on the market a portable sign unit. The company is also merchandising a house-number-lighting and bell-ringing unit.

INCLOSED AND RENEWABLE FUSES. —The Chase-Shawmut Company, Newburyport, Mass., is distributing bulletin No. 201, covering its inclosed and renewable fuses and other products.

ELECTRIC WASHING MACHINES. — The Automatic Electric Washer Company, Newton, Iowa, has recently placed on the market a new model 214 copper-tub electric washer.

CRANES. — The Universal Crane Company, Cleveland, is distributing bulletin No. 11, describing the Universal cranes.

EVAPORATORS. — The Griscom-Russell Company, 90 West Street, New York City, is distributing bulletin No. 330, describing the Reilly self-scaling evaporator.

TURBO-GENERATOR SETS. — "Turbo-Generator Sets" is the title of bulletin No. 28 recently issued by the Ridgway Dynamo & Engine Company, Ridgway, Pa., in which it describes the latest improvements, including its pneumatic governor.

LIGHTING FIXTURES. — The Lightolier Company, 569 Broadway, New York City, is distributing catalog No. 23, entitled "Immediate Delivery," covering many different types of "Lightoliers."

MOTORS.—The Advance Electric Company, St. Louis, has recently issued pocket catalog No. 19, describing the "Advance" motors for alternating current for either single or polyphase circuits in sizes from ½ hp. to 10 hp.

MOTOR.—A new single-phase motor of the repulsion-induction type has recently been put in production by the Robbins & Myers Company, Springfield, Ohio. This type "R" motor is furnished in ½-hp. size only, but sizes ranging from ¼-hp. to 1-hp. will soon be in regular production.

CONDENSER.—The Coto-Coil Company, 87 Willard Avenue, Providence, R. I., is distributing bulletin No. 1, describing its variable air condenser for radio.

ELECTRIC HOISTS.—The Sprague Electric Works of the General Electric Company, 527 West Thirty-Fourth Street, New York City, have issued bulletin No. 48,967.

INSULATORS.—The Hopewell Insulation & Manufacturing Company, Hopewell, Va., has recently published catalog No. 1, covering its various types of insulators.

ILLUMINATION.—"Illumination Design Data" is the title of bulletin No. 41 recently issued by the National Lamp Works of General Electric Company, Nela Park, Cleveland.

FOUNDRY SAND CUTTER.—The Whiting Corporation, Harvey, Ill., is distributing a four-page folder describing its motor-driven sand-cutting and screening machine for use in foundries.

New Companies

THE OCEANIC ELECTRICAL SUPPLY COMPANY, New York, N. Y., has been incorporated by J. V. Schraig, L. M. Fox and J. J. Gill, 1941 Benson Avenue, Brooklyn. The company is capitalized at $20,000 and proposes to manufacture electrical equipment and supplies.

THE UNITED ELECTRIC SERVICE COMPANY, Springfield, Mass., has been incorporated by Edward A. Higney, Palmer; John G. Waddell and Charles J. Weston, Springfield. The company is capitalized at $100,000 and proposes to manufacture electrical appliances and equipment.

THE CRAWFORD MANUFACTURING COMPANY, Concord, N. H., has been incorporated with a capital stock of $115 000 to manufacture electric motors. The incorporators are John J. Crawford, Philip Gill and Clarence R. Blanchard.

THE CYNTHIANA LIGHT & POWER COMPANY, Cynthiana, Ind., has been organized with a capital stock of $20,000. The directors are W. O. Boren, G. E. Meadows, V. D. Smith, J. E. Stevens, J. E. Gudgel, I. L. Turman and P. M. Kifer.

THE KEPS ELECTRICAL SUPPLY COMPANY, Pittsburgh, Pa., has been incorporated by Edward J. Kelsky, Monroe W. Petre, John Ehler and Jacob L. Simon, 1409 Park Building, to manufacture electrical fixtures and supplies.

THE AUTOMATIC ELECTRICAL MACHINE COMPANY, Wilmington, Del., has been incorporated by C. B. Outten, C. T. Cohee and S. L. Mackey. The company is capitalized at $500,000 and proposes to manufacture electrical machinery.

THE AUTOMATIC LIGHT & POWER COMPANY, Norfolk, Va., has been incorporated with a capital stock of $24,000. V. L. Cullen is president and R. P. W. Baylor is secretary.

THE AMERICAN FIBER CONDUIT CORPORATION, Fulton, N. Y., has been incorporated by G. Grossman, G. M. Fanning and R. F. Freeman. The company is capitalized at $350,000 and proposes to manufacture electrical conduits.

THE BERTRAND F. MILLER COMPANY, INC., Trenton, N. J., has been incorporated by N. F. House, Clifford M. and Bertrand F. Miller. The company is capitalized at $25,000 and proposes to manufacture electrical supplies.

THE AUTOMATIC ELECTRIC SHOE POLISHING MACHINE COMPANY, Bryan, Tex., has been incorporated by J. L. Edge, C. A. Harris and J. T. Maloney. The company is capitalized at $75,000 and proposes to manufacture special electrically operated machinery.

Record of Electrical Patents

Notes on United States Patents

(Issued April 12, 1921)

1,374,559. INDUCTION-MOTOR CONTROL; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Oct. 9, 1915. Starting and running control.

1,374,561. TROLLEY HANGER; Harry L. Garbutt, Wilkinsburg, Pa. App. filed Jan. 16, 1917. Will not release conductor though insulating units are broken.

1,374,562. CONTROL APPARATUS; Arthur J. Hall, Wilkinsburg, Pa. App. filed Dec. 2, 1916. Cooling tower for liquid rheostat.

1,374,564. RECUPERATIVE SYSTEM FOR ALTERNATING-CURRENT COMMUTATOR MOTORS; Rudolf E. Hellmund, Swissvale, Pa. App. filed Sept. 9, 1916. For alternating-current motors of inducing-field commutator type.

1,374,565. ALTERNATING-CURRENT COMMUTATOR MOTOR; Rudolf E. Hellmund, Swissvale, Pa. App. filed Jan. 5, 1917. Single-phase motors having commutated rotor winding.

1,374,591. ELECTRIC HEATER; Edwin N. Lightfoot, New York, N. Y. App. filed Jan. 9, 1920. Radiant.

1,374,606. PRINTING TELEGRAPHY; Harry Pfannenstiehl, East Orange, N. J. App. filed June 8, 1917. Receiving apparatus.

1,374,630. SELECTING MECHANISM; Erwin P. Bancroft, Brooklyn, N. Y. App. filed July 10, 1917. Printing telegraph.

1,374,639. ELECTRIC HEATER; Henry Dicks, New York, N. Y. App. filed Nov. 3, 1919. Radiant.

1,374,640. WELDING; Ethan I. Dodds, Pittsburgh, Pa. App. filed July 21, 1920. Welding of closures to boiler sheets.

1,374,647. ARC INCANDESCENT ELECTRIC LAMP; Edward A. Gimingham, London, Eng. App. filed Oct. 15, 1915. Has appearance of ordinary incandescent lamp.

1,374,658. ELECTRIC FAN; George H. Hohnsbeen, Minneapolis, Minn. App. filed Feb. 24, 1919. Fan and heater.

1,374,679. DEGASIFYING PROCESS; John B. Pratt, Schenectady, N. Y. App. filed March 15, 1920. Removal of gas from electrodes.

1,374,688. TRANSMITTER; Frank E. Summers, Memphis, Mo. App. filed May 12, 1919. Variable contact.

1,374,689. AIR-CONDITIONING PROCESS AND APPARATUS; Anthony P. Torrey, North Glenside, Pa. App. filed April 27, 1920. For sterilizing dehydrating dryers.

1,374,690. BATTERY-CHARGING SYSTEM; Oliver C. Traver, Schenectady, N. Y. App. filed May 12, 1920. For disconnecting generator when voltage drops below voltage of battery.

1,374,693. ELECTRIC HEATER HAVING HEATING FABRICS; Francois E. B. Vernet, Paris, France. App. filed May 11, 1920. Weft of resistance wire and warp of asbestos thread.

1,374,711. ARC-WELDING COMPOSITION; James C. Armor, Pittsfield, Mass. App. filed Aug. 30, 1919. Flux.

1,374,727. PROTECTIVE DEVICE; Henry G. French, Schenectady, N. Y. App. filed Oct. 25, 1919. Induction type.

1,374,733. ELECTRICAL TRANSMITTING APPARATUS; Henry K. Harris, Westminister, London, England. App. filed Oct. 17, 1917. Advertising device.

1,374,766. ELECTRIC INCANDESCENT LAMP; Haruhiko Ozaki, Yokohama, Japan. App. filed Oct. 19, 1918. Filament support.

1,374,802. ELECTRIC FURNACE; Edwin Appleby, Chicago, Ill. App. filed Nov. 19, 1919. For manufacture of calcium carbide.

1,374,826. PROTECTIVE DEVICE; Elmer E. F Creighton, Schenectady, N. Y. App. filed March 9, 1917. For lines of communication paralleling transmission system.

1,374,832. VACUUM-TUBE BASE; Harold P. Donle, Meriden, Conn. App. filed Sept. 27, 1919.

1,374,856. REGULATOR FOR DYNAMO-ELECTRIC MACHINES; Bennett M. Leece and Harry C. Branch, Cleveland, Ohio. App. filed Aug. 15, 1917. For automobile.

(Issued April 19, 1921)

15,089 (reissue). RADIO TELEPHONY; Carl R. Englund, East Orange, N. J. App. filed March 5, 1918. Modulated portion of high frequency wave radiated.

1,374,916. ELECTROLYTE FOR STORAGE BATTERIES; William Gardiner, Chicago, Ill. App. filed June 9, 1919. Solid or semi-solid.

1,374,918. CURRENT-DENSITY INDICATOR; Edwin Heil, Wichita, Kan. App. filed March 10, 1919. For plating or electrolysis.

1,374,929. SYNCHRONIZER; Henry I. Larson, Milwaukee, Wis. App. filed Nov. 3, 1919. Master clock.

1,374,935. AUTOMATIC TEMPERATURE REGULATOR FOR ELECTRICALLY HEATED DEVICES; Donald H. McGogy, Portland, Ore. App. filed May 3, 1919. Controlled by thermostat.

1,374,948. ELECTRICAL INDICATING DEVICE; Rudolph S. O'Neil, London, England. App. filed March 1, 1920. For ships.

1,374,976. ELECTROLYTIC CELL; Herbert I. Allen and Kent R. Fox, Portland, Me. App. filed June 1, 1920. For increasing active area of cathodes and anodes.

1,374,998. INSULATOR; Charles Le G. Fortescue, Pittsburgh, Pa. App. filed Feb. 14, 1918. For high-voltage lines.

1,375,007. INSULATED SQUIRREL-CAGE WINDING; Austin Kimble, Wausau, Wis. App. filed May 12, 1919. Electroplated on core.

1,375,012. ELECTRIC BATTERY; David Pepper, Philadelphia, Pa. App. filed Nov. 29, 1919. For flashlights.

1,375,018. MOTOR; Camillo Savino, New York, N. Y. App. filed Aug. 30, 1920. Reciprocating electric motor.

1,375,034. TROLLEY RETRIEVER; Antoinette A. Cohen, Birmingham, Mich. App. filed Aug. 11, 1919.

1,375,050. APPARATUS FOR THE TREATMENT OF RHEUMATISM, GOUT, SCIATICA, NEURALGIA AND SIMILAR AILMENTS; Joseph Krauer, Heaton Chapel, England. App. filed May 1, 1916.

1,375,059. SIGNAL SYSTEM; Alfred E. Meyer, Cincinnati, Ohio. App. filed Feb. 11, 1918. Alarm or watchmen's time recorder.

1,375,072. METHOD OF AND MEANS FOR ASSEMBLING CORE LAMINATIONS; Charles Atkins, Cincinnati, Ohio. App. filed Jan. 19, 1916. Improved clamp.

1,375,084. ELECTRIC HEATING ELEMENT AND METHOD OF MAKING THE SAME; John W. Cox, Erie, Pa. App. filed Feb. 3, 1919. To heat a hollow tube.

1,375,124. BRUSH HOLDER; Walter J. Warder, Jr., Chicago, Ill. App. filed Jan. 17, 1918. Self-righting brush and holder.

1,375,133. ARMATURE INSULATION; Jasper F. Cullin, Detroit, Mich. App. filed Sept. 16, 1920. Means for insulating windings of armatures from each other and from cores.

1,375,145. ELECTRIC BURNER; Coral V. Funderburg, Yellow Springs, Ohio. App. filed May 19, 1919. For stoves.

1,375,152. TROLLEY-WIRE HANGER; Edward Heydon, Indianapolis, Ind. App. filed Nov. 24, 1919.

1,375,161. MOTOR AND DYNAMO CONSTRUCTION; Clyde W. Landers, New York, N. Y. App. filed April 16, 1920. No commutator.

1,375,192. DYNAMO; Ernest A. Watson, Coventry, England. App. filed March 31, 1920. For automobile.

1,375,194. ELECTRIC HEATER; Alfred G. Werner, Omaha, Neb. App. filed Dec. 30, 1919. Supported in socket.

1,375,202. DRY CELL; Raymond C. Benner and Harry F. French, Fremont, Ohio. App. filed Aug. 14, 1919. Process of applying coatings to inside of zinc can.

1,375,209. TELEPHONE MOUTHPIECE; John Chefer, Chester, Pa. App. filed Aug. 31, 1920.

1,375,230. TELEPHONE EXCHANGE SYSTEM; John N. Reynolds, Greenwich, Conn. App. filed March 29, 1917. Automatic switching.

1,375,253. SPARK-PLUG INTENSIFIER; Alfred A. Jackson, Denver, Col. App. filed Sept. 18, 1919. Auxiliary gap.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

LINCOLN, ME. — Electrically operated machinery will be installed in the proposed worsted mill of the Lincoln Worsted Company, to be built at a cost of $100,000. A machine shop will also be erected. The company was recently organized with a capital stock of $600,000. L. J. Coburn is manager. F. A. Petterson, 16 Central Street, Bangor, is architect.

FALL RIVER, MASS.—The Fall River Electric Light Company has been granted permission to construct underground conduits on various streets of the city.

WINCHESTER, MASS.—Plans are being prepared for the construction of a one-story power house at the local plant of Beggs & Cobb.

Middle Atlantic States

ITHACA, N. Y.—Considerable electrical and mechanical equipment will be required for the four-story and basement chemical building to be erected by Cornell University on East Avenue, to cost $2,000,000. Henry R. Kent, 141 Broadway, New York City, is engineer.

LONG BEACH, N. Y.—The Long Beach Power Company, Park Street, has awarded a contract for the construction of a one-story power plant, to cost about $125,000 with equipment, to Johnson & Molitor.

NEW YORK, N. Y. — The New York Edison Company, Irving Place and Fifteenth Street, is having plans prepared for the construction of a substation at Fortieth Street and First Avenue, to cost about $200,000. W. Whitehill, 12 Elm Street, is architect and engineer.

NEW YORK, N. Y.—Electric traveling cranes, hoisting and conveying machinery will be installed in the new piers now under construction by the city at a point between Tompkinsville and Clifton, S. I. A total of twelve new piers will be constructed at a cost of about $20,000,000. They will vary in width from 125 ft. to 290 ft. and in length from 1,030 ft. to 1,200 ft. It is proposed to have the structures equipped and ready for service early in fall.

PERRY, N. Y.—The Perry Light Company has been granted permission by the Public Service Commission to erect an electric power plant. Distribution lines will also be built for service to various sections of Genesee Falls Township.

ST. GEORGE, S. I., N. Y.—The Department of plants and structures, Municipal Building, New York, is having preliminary plans prepared for the construction of the proposed municipal electric power plant at the Ferry Terminal, St. George, to cost about $1,258,000. City Commissioner Grover A. Whalen is in charge.

NEWARK, N. J. — Negotiations are under way between the Broad Street Improvement Association and the City Commission for extensions to the street-lighting system on Broad Street reaching to the Lackawanna Railroad station on the north and Lincoln Park on the south.

GETTYSBURG, PA.—The Adams Light & Power Company is being organized for the purpose of erecting an electric power plant with transmission and distribution lines to furnish service in the northern section of Adams County. The districts to be served by the company include Bendersville and York Springs Borough, Menallen, Tyrone, Hamilton, Huntington, Butler, Latimore and Reading Townships.

HARRISBURG, PA.—Considerable electrical and mechanical equipment and refrigerating apparatus will be required in connection with the proposed cold-storage plant to be built by the American Cold Storage Company on South Second Street.

PITTSBURGH, PA. — Arrangements are being made by the Philadelphia Company for an issue of $10,000,000 in bonds for its subsidiary, the Duquesne Light Company, the proceeds to be used for extensions, improvements, etc.

WATSONTOWN, PA.—Preliminary estimates are being made and surveys are under way with a view of constructing an electric light and power station to serve the manufacturing industries in Watsontown. The present plans include furnishing electricity to the borough.

CUMBERLAND, MD.—Plans are under way for the construction of a group of buildings, including an electric generating plant, for the Paragon Motor Car Company, Connellsville, Pa., at Cumberland. The cost, including machinery, is estimated at $1,000,000.

PIEDMONT, MD.—The Piedmont Electric Light & Power Company has entered into agreement with the Edison Electric Illuminating Company, Cumberland, for a supply of electricity to serve Westernport, Luke and Piedmont.

MORGANTOWN, W. VA. — The North American Coal Company, Maidsville, near Morgantown, contemplates the reconstruction of its power house and motor building recently destroyed by fire.

WASHINGTON, D. C.—Bids will be received by the Bureau of Yards and Docks, Navy Dept., Washington, D. C., for furnishing the following: Until May 20, Brooklyn, Schedule 7,977—10,000 lb. electric welding wire; Schedule 7,996—f.o.b. 25 motor-generators. Until May 31, Portsmouth, Schedule 7,964—miscellaneous quantity of motor, generator and control equipments.

North Central States

UNION CITY, MICH.—Bids, it is understood, are being received by the Council of Union City for the construction of a hydro-electric plant to cost about $150,000. Holland, Akerman & Holland, 166 East Liberty Avenue, Ann Arbor, are architects.

CLEVELAND, OHIO.—An ordinance has been submitted to the City Council authorizing an expenditure not to exceed $18,000 for electric lamps for the division of light and power.

MIDDLETOWN, OHIO.—Plans have been approved by the Chamber of Commerce for the installation of an ornamental lighting system on several streets in the business section of Middletown.

CAMBRIDGE CITY, IND.—The Wayne Utility Service Company has been organized with a capital stock of $25,000 for the purpose of supplying electrical service in Cambridge City and surrounding towns. C. M. Haworth, Clementine Overman and Wilfred Jessup are interested in the company.

GEM, IND.—Bids, it is reported, will soon be received by the secretary of the Gem Electrical Service Company for furnishing all materials and for the construction of a single-phase transmission line and distribution system to supply electricity in Gem. Gem has no post office.

DAHLGREN, ILL.—Fuller & Beard, engineers, Chemical Building, St. Louis, Mo., have prepared plans for extensions to the municipal electric light and power plant.

ROCKFORD, ILL.—The West End Improvement Association is considering the extension of electric light service in that district.

HURLEY, WIS.—The City Council is considering the installation of an ornamental lighting system in Hurley.

GRISWOLD, IOWA. — The question of submitting to the voters a proposal to issue $50,000 in bonds for a municipal power plant is under consideration.

IOWA FALLS, IOWA. — Petitions are being circulated asking the City Council to call a special election to submit to the voters a proposal to issue $150,000 for the construction of an electric light plant. The Community Club is interested.

NEW HAVEN, MO. — Bids will be received May 20 for improvements to the municipal electric light and water system, including the construction of a power house and the installation of a 30-hp. semi-Diesel fuel oil engine; 25-kva., three-phase, alternating-current generator with exciter and switchboard panel; 75 gal.-per-minute motor-driven turbine pump for 260-ft. total head, or alternate bids on double-acting type of pumping unit for 50 gal. per minute; moving and re-erecting old machinery and oil storage tank. Fuller & Beard, Chemical Building, St. Louis, are engineers.

ST. LOUIS, MO.—The Board of Estimate and Apportionment is considering calling an election to vote on the proposal to issue $10,000,000 in bonds for street and sewer improvements and for the completion of the electric street-lighting system.

LAWRENCE, KAN.—The State Board of Administration is having plans prepared for the construction of a two-story power house, 120 ft. x 180 ft., to cost about $100,000. R. S. Gamble, 1415 Fillmore Street, Topeka, is architect.

MINNEAPOLIS, KAN. — Bonds to the amount of $60,000 have been voted for the construction of a municipal electric light plant. A. D. Tood is clerk.

Southern States

GIBSLAND, LA.—The installation of an electric light plant in Gibsland is contemplated. H. Houck is interested.

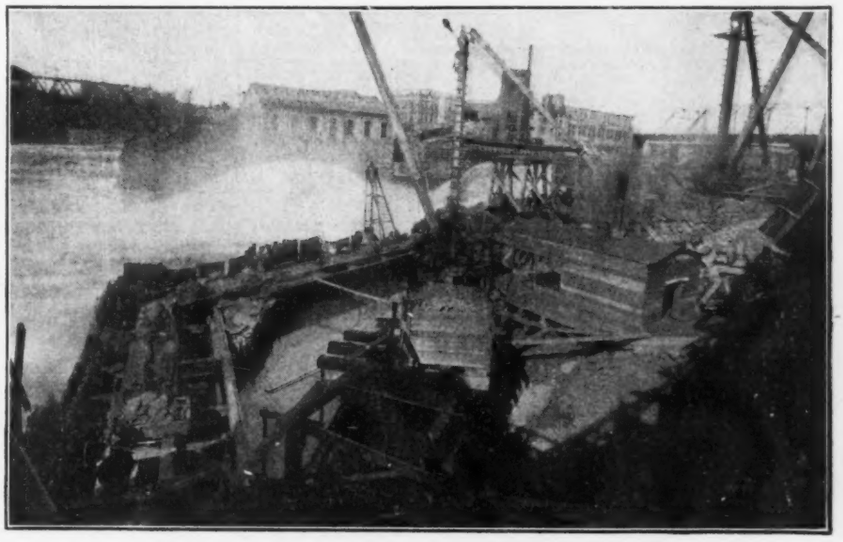
FULLERTON, CAL.—The Board of City Trustees is arranging for the installation of a new ornamental lighting system on Spadra Street and other thoroughfares in the business district.

LOS ANGELES.—The Little Rock Power & Water Company has applied to the State Water Commission for permission to utilize waters from the Little Rock Creek, Los Angeles County, to be used in connection with a hydro-electric plant to be erected at a cost of about $680,000.

PASADENA, CAL.—Bonds to the amount of $50,000 have been voted for extensions to the municipal electric plant on Glenarm Street. The plans provide for erection of a building and the purchase of a boiler.

SAN BERNARDINO, CAL. — The City Engineering Department is considering the erection of a municipal hydro-electric plant. Application has been made for water rights to permit a plant of about 5,000 hp. capacity.

WOODLAND, CAL.—The City Trustees have awarded a contract to the Municipal Improvement Company of Oakland for the installation of an electrolier system in the city and lighting Main Street from West to East Streets with "Marbelite" lamp standards. The cost is estimated at $21,000.



WASHINGTON WATER POWER SPOKANE RIVER PROJECT

In the foreground is shown the cofferdam being built on the south bank of the middle channel of the Spokane River. A 14,500-hp. wheel will be installed.

LITTLE ROCK, ARK. — The Arkansas Light & Power Company is considering extensions to its power station. The plans provide for the installation of machinery to double the present output of the power house.

Pacific and Mountain States

ILWACO, WASH.—A company is being organized with a capital stock of $70,000 for the purpose of extending an electric lighting system from Knappton to north beach towns. J. W. Howarton of Ilwaco is interested.

WALLA WALLA, WASH. — Application has been made by K. G. Harlan for permission to appropriate 150 sec.-ft. of water from Walla Walla River for the development of 3,500 hp. for commercial purposes, at a cost of about $300,000.

WENATCHEE, WASH. — The construction of a new power transmission line from the Great Northern Railway Company's electric plant, 10 miles above Leavenworth, in Tumwater Canyon, has been started. Negotiations, it is reported, are under way by which the Puget Sound Power & Light Company is to take over the power interests of the Great Northern Railway Company and also serve the entire community with electricity for commercial purposes.

BANKS, ORE.—Steps have been taken by the Banks Commercial Club to secure electrical service for the town of Banks.

SALEM, ORE.—L. H. McMahan has applied for permission to appropriate 300 sec.-ft. of water from Mill Creek to develop 1,500 hp. for commercial purposes. The cost is estimated at $50,000.

WHITE SULPHUR SPRINGS, MONT.—Richard T. Ringling has applied to the Federal Power Commission for authority to construct a 50-ft. dam and a 1-mile pipe line to power house to develop 400 hp. in Meagher County.

POWELL, WYO.—At an election to be held May 10 the proposal to issue $17,000 in electric light bonds will be submitted to the voters.

Canada

MONCTON, N. B.—According to the decision reached by the New Brunswick Electric Power Commission, Moncton will be supplied with electricity generated at Musquash and Lepreaux Falls, by means of a 66,000 volt transmission line to be erected. Contract for the construction of the power house at Musquash, it is reported, will be awarded in a few days. C. O. Foss is engineer of the commission. P. H. & C. H. Mitchell, Toronto, are consulting engineers.

LONDON, ONT. — The Public Utilities Commission contemplates extensions to the ornamental street-lighting system in London. The commission has also authorized E. V. Buchanan, general manager, to proceed with the purchase and installation of underground cables on Dundas and Richmond Streets, for which conduits have been already laid.

TORONTO, ONT. — The Hydro-Electric Commission, University Avenue, contemplates the construction of a radial substation on York Street, to cost about $200,000.

ALABAMA LIGHT AND TRACTION ASSOCIATION. Secretary-treasurer, J. P. Ross, Birmingham Railway, Light & Power Co.

AMERICAN ASSOCIATION OF ENGINEERS. Secretary, C. E. Drayer, 63 East Adams St., Chicago, Ill. Annual convention, Buffalo, N. Y., May 9-11.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, E. B. Burritt, 8 West 40th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University of Bethlehem, Pa.

AMERICAN ENGINEERING STANDARDS COMMITTEE. Secretary, P. G. Agnew, 29 W. 39th St., New York City.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS, INC. Secretary, F. A. Molitor, 35 Nassau St., New York City.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 33 West 39th St., New York City. Board of directors meets monthly. Sections and branches in the principal electrical centers throughout the country. Annual convention, Salt Lake City, Utah, June 20-25.

AMERICAN PHYSICAL SOCIETY. Secretary, Dayton C. Miller, Case School of Applied Science, Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary-treasurer, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY. Secretary, H. C. Forbes, 29 W. 39th St., New York City.

ARKANSAS UTILITIES ASSOCIATION. Secretary, S. E. Dillon, Hot Springs, Ark. Annual meeting, Hot Springs, Ark., May 11-12.

ASSOCIATED MANUFACTURERS OF ELECTRICAL SUPPLIES. General secretary, C. E. Dustin, 30 East 42d St., New York City. Annual meeting, New London, June 27-30.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, Preston S. Millar, Electrical Testing Laboratories, New York.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, John F. Kelly, Empire Building, Pittsburgh, Pa.

ASSOCIATION OF MUNICIPAL ELECTRICAL UTILITIES OF ONTARIO. Secretary, S. R. A. Clement, 190 University Ave., Toronto.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-treasurer, Joseph A. Andreucetti, Chicago & Northwestern Railway, Chicago, Ill.

BRITISH COLUMBIA ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary-treasurer, Capt. W. J. Conway, 406 Yorkshire Building, Vancouver, B. C.

CANADIAN ELECTRICAL ASSOCIATION, affiliated with N. E. L. A. Secretary-treasurer, Eugene Vinet, Shawinigan Water & Power Co., Montreal, Canada. Annual meeting, Quebec, June 15-17.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary-treasurer, M. B. W. Baker, Denver, Col.

CONFERENCE CLUB. Secretary, Sullivan W. Jones, 19 West 44th St., New York City.

COMMERCIAL SECTION, N. E. L. A. Secretary, R. H. Tillman, Baltimore, Md.

EASTERN NEW YORK SECTION, N. E. L. A. Secretary, J. L. Hemphill, General Electric Co., Schenectady, N. Y.

ELECTRIC HOIST MANUFACTURERS' ASSOCIATION. Secretary-treasurer, E. Donald Tolles, 52 Broadway, New York City.

ELECTRIC FURNACE ASSOCIATION. Secretary, Dr. C. G. Schluederberg, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

ELECTRICAL MANUFACTURERS' CLUB. Secretary, F. L. Bishop, Hartford Faience Co., Hartford, Conn.

ELECTRICAL MANUFACTURERS' COUNCIL. Executive secretary, Frederic Nicholas, 522 5th Ave., New York City.

ELECTRICAL SAFETY COUNCIL. Secretary, Dana Pierce, 25 City Hall Place, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. General secretary, Franklin Overbaugh, 411 South Clinton St., Chicago, Ill. Annual convention, Hot Springs, Va., May 25-27.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, ATLANTIC DIVISION. Secretary, E. Donald Tolles, 52 Broadway, New York City.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION, PACIFIC COAST DIVISION. Secretary, Albert H. Elliot, 502 Flatiron Building, San Francisco, Cal.

ELECTRICAL TRADE ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

Directory of Electrical Associations

Printed in the First Issue of Each Month

ELECTRIC POWER CLUB. Secretary, C. H. Roth, 1410 West Adams St., Chicago, Ill.

EMPIRE STATE GAS AND ELECTRICAL ASSOCIATION. Secretary, Charles H. B. Chapin, Grand Central Terminal Building, New York City.

FLORIDA ENGINEERING SOCIETY. Secretary, J. R. Benton, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary-treasurer, R. V. Prather, Springfield, Ill.

ILLUMINATING ENGINEERING SOCIETY. General secretary, Clarence L. Law. Sections in New York, Philadelphia, Pittsburgh, Cleveland, Chicago and Boston. Annual convention, Rochester, N. Y., Sept. 26-29.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, Thomas Donohue, Lafayette, Ind.

INDUSTRIAL ELECTRIC HEATING ASSOCIATION. Secretary, Homer Kunz, Toledo Railways & Light Co., Toledo, Ohio.

INSTITUTE OF RADIO ENGINEERS. Secretary, Alfred N. Goldsmith, College City of New York, New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England.

IOWA SECTION, N. E. L. A. Secretary-treasurer, M. G. Linn, Des Moines, Iowa.

JOVIAN ORDER. Jupiter (president), Arthur J. Binz, Houston, Tex.

KANSAS PUBLIC SERVICE ASSOCIATION. Secretary-treasurer, W. W. Austin, Cottonwood Falls, Kan.

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MISSISSIPPI ELECTRIC ASSOCIATION, affiliated with the N. E. L. A. Secretary, E. S. Myers, Vicksburg, Miss.

MISSOURI ASSOCIATION OF PUBLIC UTILITIES. Secretary-treasurer, F. D. Beardslee, 315 N. 12th St., St. Louis, Mo.

NATIONAL ASSOCIATION OF ELECTRICAL CONTRACTORS AND DEALERS. Secretary, W. H. Morton, 110 West 40th St., New York City, N. Y. State associations in Alabama, Arkansas, Connecticut, Georgia, Kansas, Illinois, Indiana, Iowa, Louisiana, Maryland, Massachusetts, Michigan, Minnesota, Missouri, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee and Wisconsin. Annual convention, Buffalo, N. Y., July 18-23.

NATIONAL COUNCIL OF LIGHTING FIXTURE MANUFACTURERS. Secretary, C. W. Hoffrichter, 8410 Lake Ave., Cleveland, Ohio.

NATIONAL ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary-treasurer, William L. Smith, Northeastern College, Boston, Mass.

NATIONAL ASSOCIATION OF RAILWAY AND UTILITY COMMISSIONERS. Secretary, James B. Walker, Public Service Commission of the State of New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive manager, M. H. Aylesworth, 29 West 39th St., New York City. Annual convention, Chicago, May 31-June 3.

NATIONAL ELECTRICAL CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1350 Marquette Building, Chicago, Ill. Annual meeting, Richmond, Va., May 19-20.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary of electrical committee, Ralph Sweetland, 141 Milk St., Boston, Mass. Annual meeting, San Francisco, Cal., June 14-16.

NEBRASKA SECTION, N. E. L. A. Secretary-treasurer, B. H. Conlee, Nebraska Gas & Electric Co., Beatrice, Neb.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 15 State St., Boston, Mass.

NEW ENGLAND GEOGRAPHIC DIVISION, N. E. L. A. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass.

NEW MEXICO ELECTRICAL ASSOCIATION. Secretary-treasurer, Charles E. Twogood, Albuquerque, N. M.

NEW YORK ELECTRICAL CREDIT ASSOCIATION. Secretary, W. J. Kreger, 47 W. 34th St., New York City.

NEW YORK ELECTRICAL SOCIETY. Secretary, George H. Guy, 29 West 39th St., New York City.

NORTH CENTRAL GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. E. Young, Minneapolis General Electric Co., Minneapolis. Annual convention, Duluth, Minn., June 14-16.

NORTHWEST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, L. A. Lewis, Washington Water Power Co., Spokane, Wash.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, July 12-15.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus.

OKLAHOMA UTILITIES ASSOCIATION. Secretary, H. A. Lane, 611 State National Bank Building, Oklahoma City.

PACIFIC COAST GEOGRAPHIC DIVISION, N. E. L. A. Secretary, S. H. Taylor, Electric Railway & Manufacturers' Supply Co., San Francisco, Cal. Annual meeting, Del Monte, Cal., June 7-9.

PENNSYLVANIA ELECTRIC ASSOCIATION, State Section N. E. L. A. Secretary, H. M. Stine, 211 Locust St., Harrisburg, Pa.

PUBLIC RELATIONS SECTION, N. E. L. A. Chairman, J. E. Davidson, Omaha, Neb.

PUBLIC SERVICE ASSOCIATION OF VIRGINIA. Secretary, W. J. Kehl, Virginia Railway & Power Co., Richmond, Va.

PUBLIC UTILITIES ASSOCIATION OF WEST VIRGINIA. Secretary, W. C. Davisson, West Virginia Water & Electric Co., Charleston, W. Va.

RADIO CLUB OF AMERICA. Secretary, T. J. Styles, 1112 S. Curtis Ave., Richmond Hill, Queens Borough, N. Y.

ROCKY MOUNTAIN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, A. C. Cornell, Denver, Col.

SOCIETY FOR ELECTRICAL DEVELOPMENT, INC. General manager, J. M. Wakeman, Guaranty Building, 522 5th Ave., New York City. Annual meeting, New York City, May 10.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Dean F. L. Bishop, University of Pittsburgh, Pittsburgh, Pa.

SOUTHEASTERN GEOGRAPHIC DIVISION N. E. L. A. Secretary-treasurer, Charles A. Collier, Georgia Railway & Power Co., Atlanta, Ga.

SOUTHWESTERN GEOGRAPHIC DIVISION, N. E. L. A. Secretary, H. A. Lane, Oklahoma Utilities Association, Oklahoma City, Okla. Annual meeting, Hot Springs, Ark., May 13-14.

SOUTHERN CALIFORNIA ELECTRICAL CONTRACTORS AND DEALERS' ASSOCIATION. Secretary-treasurer, J. E. Wilson, 425 Consolidated Realty Building, Los Angeles, Cal.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, H. S. Cooper, 403-4 Slaughter Building, Dallas, Tex. Annual convention, Galveston, Tex., May 18-21.

SOUTHWESTERN SOCIETY OF ENGINEERS. Secretary, C. E. Barglebaugh, 721 First National Bank Building, El Paso, Tex.

TECHNICAL SECTION, N. E. L. A. Secretary, W. C. Anderson, 29 West 39th St., New York City.

TORONTO ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, E. F. W. Salisbury, 615 Yonge St., Toronto, Ont.

TRI-STATE WATER AND LIGHT ASSOCIATION. Secretary-treasurer, W. F. Steiglitz, Columbia, S. C. Annual meeting, Asheville, N. C., June 15-16.

VERMONT ELECTRICAL ASSOCIATION. Secretary-treasurer, A. B. Marsden, Rutland, Vermont.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 175 West Jackson Blvd., Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS, ELECTRICAL SECTION. Secretary, E. S. Nethercut, 1735 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRICAL ASSOCIATION. Secretary, J. P. Pulliam, 1408 First National Bank Building, Milwaukee, Wis.